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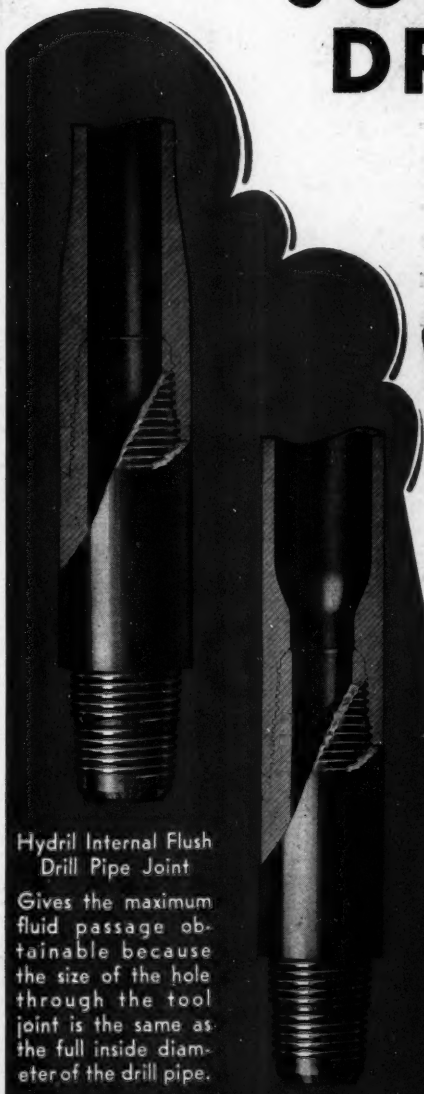

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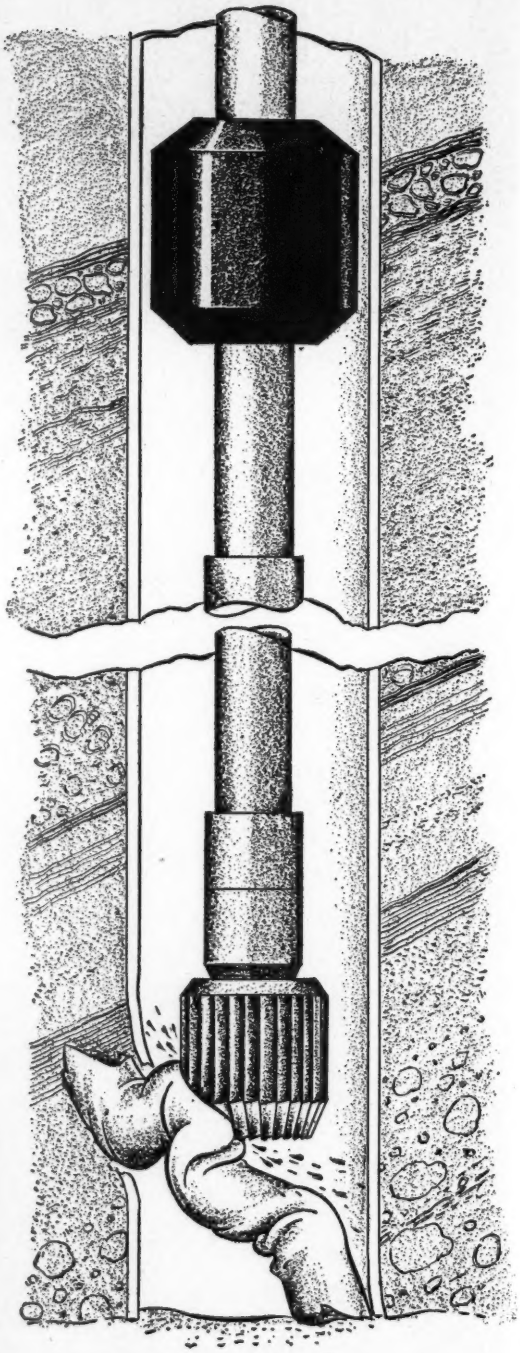

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CALIFORNIA
OIL WORLD
and Petroleum Industry

DECEMBER 3, 1936
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THE WORLD'S FIRST OIL TRADE PUBLICATION

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Nov. 30-Dec. 4—American Society of Mechanical Engineers, Annual Meeting, New York.

Dec. 1—Interstate Oil Compact Commission Meeting, Oklahoma City, Okla.

Dec. 4—Mid-Continent Oil & Gas Association, Texas Division, Houston, Texas.

Dec. 5-13—First International Consumers Petroleum Exposition, Convention Hall, Detroit, Mich.

Dec. 18—Official date for annual Christmas Jinks of Calif. Oil & Gas Assn. Wildcat Committee. The place, Biltmore Hotel, L. A. The Wildcats promise better and funnier entertainment than ever, including an original play.

Jan. 7—Meeting of the Basin Chapter, A.P.I.

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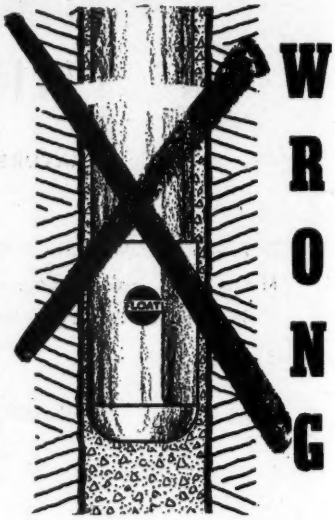

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BAKER ROTARY WALL SCRAPER

CALIFORNIA
OIL WORLD
and Petroleum Industry

SOCIALIZATION (sovietization) of industry will get a big boost and the American principle of private enterprise and initiative a hard blow, should California undertake to develop oil under the tidelands by state action. Such a move would be heartily cheered in the inner circles at Washington where attempts to sovietize industry, first oil and gas, then others, have been brewing for years past. Moscow would consider it a battle won for the extinction of personal liberty and initiative.

Success of the initiative submitted at the polls a few weeks ago was ardently desired by persons who saw in its passage a final settlement of a question that might lead us along the dangerous path that begins to loom ahead of us. Among those who so voted and worked for Proposition No. 4 for these reasons were some who wished it had been somewhat differently drawn, but who saw clearly the vital question at stake and cast aside minor personal wishes.

Defeat of this measure at the polls has thrown part of official Sacramento into hysteria. Our worthy governor is quoted as declaring that the state will be able to get enough from the tideland oil to abolish all taxes and run the entire government. However, he does not know any more about oil than he does about anything in the way of state government. Controller Riley proposes a plan for the state to condemn land for drill sites along the shore and let slant drilling contracts by competitive bidding. He thinks thus the state will be able to get for itself 50% to 60% of the oil. Also, the Controller has been quoted in the press as declaring that 500,000,000 bbls. should be recovered from the Huntington Beach tide lands alone. His opinion is as valuable as the governor's and neither of them has had a single day's experience in oil.

We are reliably informed that competent attorneys have rendered opinions to the effect that the state may not constitutionally exercise the power of eminent domain in behalf of any enterprise it owns or controls in its proprietary, not sovereign, capacity. They cite several state supreme court decisions to that effect. If these attorneys are correct in their construction of the law, unless the high tribunal reverses itself or the state constitution be amended, Mr. Riley's scheme will go on the judicial rocks immediately upon its launching.

But assuming that some way be found to put the scheme of state oil development into operation, its first effect would be the encouragement of every crackbrained plan for sovietizing this or that industry in any state so inclined, and the encouragement of similar plans for federal sovietization of all industry, especially oil and gas.

While in the past, state industrial enterprises, such as a cement plant, have been judiciously held liable to county and city taxes, ways would probably be found to circumvent this ruling by statute, or constitutional amendment in the case of the state's going into the oil business on a big scale. We shall, in other words, almost certainly see a non-taxed or at best only lightly taxed state enterprise started in direct competition with the most over taxed industry in the world.

An initiative petition to the Legislature is now being circulated for the enactment of a law to permit operation of the tidelands by contract with a private company. Its provisions are outlined in this issue. They deserve careful study.

Past experience indicates that all national or state business enterprises either fail or survive only by having the taxpayers make up the deficits, just as in the case of the postoffice. But the tideland oil deposits, even though much smaller than our over-excited governor and controller think, would probably be found big enough to enable a state development, once launched, to continue long enough to encourage like schemes elsewhere and to destroy investments of many millions made by citizens who have developed to its high peak the state's greatest industry.

Upton Sinclair, when a gubernatorial candidate, proclaimed his intention, if elected, of sovietizing all industry, taking oil among the first. He will rejoice if the state development scheme be put into effect.

Small independent oil operators would be the first to suffer from state competition and would have the greatest difficulty in surviving it. Strange indeed it is, that a journal which professes to be their official mouthpiece is foremost in urging on the scheme that would threaten them with ruin.

Proration of any kind, voluntary or otherwise, would be almost, if not quite, impossible with state competition in the field. We are not speculating when we say this, for we have already had experience among this line. Only last year the state finally refused to join the voluntary curtailment program, and practically ordered its present tideland wells operated to full capacity on the plea that the state needed the revenue. Any form of state-enforced proration has been flatly repudiated by the Legislature and at the polls.

Kettleman Hills North Dome---Mince Pie or Lemon Meringue?

HALF A MILLION dollars worth of the best legal and technical talent in the oil industry —hired to determine whether Kettleman North Dome is built like a mince pie or more nearly resembles a lemon meringue!

Now in its fifth week, Shell-Armstrong's suit against Kenda gives every evidence of continuing for many weeks more, and possibly for months. While the hearing is still in its earlier stages, comparatively speaking, and while it is still too early to determine the course of the trial, it may be well to review the background out of which grew the present controversy, and analyze the evidence that has been presented to date.

The government prospecting permits owned by Armstrong and directly affected by the present trial total four sections, two of which are on the eastern slope of the anticline and two on the western side. Most of the two sections on the eastern slope lie within the blue line. On the western slope, one half of one section is included in the blue line and one quarter of the other section falls within that boundary.

Original Situation

When Armstrong originally filed a complaint against the Kettleman North Dome Association and its members some of the members demurred and some answered the complaint. Standard Oil Co. answered the complaint, while Shell, Union, Petroleum Securities and Belmont all answered and filed cross complaints. Judge Yankwich heard the complaint and sustained the demurrer. An amended complaint was then filed, and a demurrer was sustained to the amended complaint without leave to amend. The case for the defendants—those actually fighting the case—was handled by Arthur Smiley, whose death a few weeks ago cut short his most recent activity in connection with the trial.

With the demurrer to the amended complaint sustained without leave to amend, the demurring defendants were, to all practical purposes, out of the case. However, other defendants had answered the complaint. Certain members demurred to cross complaints filed by Shell and Union. The demurrer was overruled.

Issues At Stake

The issues at stake in the present suit are whether all classification of land should be set aside and an accounting made from the beginning of the association's activities.

Each member's participating interest in production is on a percentage basis, computed on the percentage his acreage within the "blue line" bears to the total acreage involved.

The bone of contention appears to be a statement in the original agreement relative to the significance of the "blue line." In his opening statement for the plaintiffs, Mr. Beek contended that the "blue line" classified all lands within as productive; on that premise, he said, no land could be reclassified as unproductive until it was proved so by the drill. On the other hand, the defendants content that the land included within the original "blue line" (which extended far beyond its present limits) was merely land that was potentially productive, and that as geological surveys, investigations of petroleum engineers and analyses of core samples taken from nearby wells proved certain lands to be unproductive, "in the opinion of the board," such land was to be classified as unproductive and the participation of that land in the structure's production was to cease.

"Zig-Zag Line"

A further element of controversy has been the so-called "zig-zag line." As classification of land continued, it was decided that the lowest unit with which it would be practical to work was 10 acres. If the "smooth line" or the line determining production as determined by the most recent findings of the geologists and petroleum engineers should cross a 10-acre tract, the plaintiffs contended that the entire acreage should be included within the "blue line", even if the "smooth line" should cross but one small corner of the 10-acre plot. The directors of Kenda, however, decided that the line should be balanced, and since the leaseholders had renounced their rights to production from their individual pieces of land in return for participation in the output of the entire field, only that area actually included within the "blue line" should be credited to the leaseholder's percentage of participation in Kenda. In other words, the entire 10-acre plot should be excluded or included as a whole, depending on the percentage of the plot that fell within the "smooth line," but that if the piece were excluded, the leaseholder should receive credit only for that portion of his land that actually fell within the "smooth line." This was absolutely contrary to the "inside touching line" principle advocated by the Shell Co.

Crux of Case

The crux of the case would seem to hinge on the question of whether or not the directors of Kenda acted illegally by such reclassification of acreage based on the evidence produced by the geologists and petroleum engineers, so that the court should now step in and set aside all previous reclassification.

Geological Evidence

Harry R. Johnson, first witness for the plaintiffs, spoke at considerable length on the geology of the surrounding country, always leading up to his contention that the surrounding country was faulted, and from a U. S. Geological Survey map of 1934 which he produced, that the Kettleman North Dome itself contained certain faults.

Dr. Birkhauser, of Shell's geological staff, also produced photographs of certain surface faults at Kettleman, together with logs from 49 wells, certain conditions of which he said were indicative of faults in the areas penetrated by the wells. He also said that evidence of faulting was determined from various core samples.

From the looks of the testimony by the plaintiffs to date, it would appear as though they were attempting to show that tremendous fractures exist in the Kettleman North Dome structure. As one of

(Continued on Page 28)

Review of Developments at Kettleman Hills

By R. E. Collom and C. P. Watson

An A. I. M. E. Paper

In view of the fact that there is a very important suit regarding Kettleman Hills now in progress and also because the California Oil World has received many requests to publish this article, we present herewith the "Review of Developments at Kettleman Hill." Due to the length of the article, however, it is necessary to publish it in installments, of which this is the first. Others will follow.

VARIOUS CHAPTERS already written in the history of development of the North Dome of Kettleman Hills are monotonously identical in the one underlying theme of conservation of oil and gas. Discovered on Oct. 4, 1925, by Milham Exploration Co. (now Seaboard Oil Corp.) with its wildcat Elliot No. 1, the field has been subjected to practically every modern form of production restraint in the name of conservation. The record thus far developed shows that conservation was had for a time, at a price; and that unitization must be blessed by single ownership or 100% participation to be effective. In fact, incomplete unitization places a heavy handicap upon its participants in the competitive development that follows.

Shut-In Agreement of July 25, 1929

Not long after discovery at Kettleman but after Continental and Standard had completed several producing wells in the discovery group, came the so-called Shut-in Agreement negotiated at the instance of the Department of the Interior. This agreement became effective on July 25, 1929. The fundamental purpose of the agreement was to prevent bringing on production of some 30 wells then being drilled and forestall a flood of Kettleman oil on the market. A cooperative scheme was developed whereby wells in the discovery group would continue to produce. Two of them could not be shut-in. Drilling wells would be completed to a water shut-off in the top of the Temblor and operations suspended. Producing wells would contribute the value of 10% to 25% of their production to the owners of suspended qualifying wells. The percentage rate of drainage contribution was left to a committee or umpire. Some acreage was not placed under the agreement. This same acreage later did not come into the Kettleman Unit Agreement. Several wells on this acreage did not contribute to the drainage fund.

The first contribution under the agreement was made for November, 1929. The amount was set at 10%. Milham and Continental contributed $48,160.37, which was distributed to various operators in the North Dome on the basis of 16 wells qualified to participate. The ownerships of these 16 wells were as follows:

Continental Oil Co.	1
Genera Petroleum Corp.	2
Geo. F. Getty, Inc.	2
Pac. Western Oil Corp.	1
Milham Exploration Co.	2
Petroleum Securities	1
Shell Oil Co.	1
Standard Oil Co.	6

For December, 1929, the engineering committee of four, after considerable delay in arriving at the rate of assessment, fixed 20% as the basis of contribution. At this time, none of the wells of Standard Oil Co. in the discovery group were on production and the contribution of 20% of sales value of crude produced was confined to Continental Oil Co. and Milham Exporation Co.

The amount of the contribution for December, 1929, was $95,898.23. Eligible wells increased to 18 by addition of two wells of Standard Oil Co. The price of oil was $1.65 per barrel.

Percentage Still Not Fixed

As the amount of percentage to be fixed for contribution on account of production in January, 1930, the engineering committee was unable to agree, therefore the matter was referred to an umpire appointed by the Secretary of the Interior. From that date forward, until March, 1931, the so-called technical committee was never able to agree and the umpire continued to fix the maximum contribution of 25%. The final disbursement was made for the month of March, 1931, and the number of qualified participating wells had increased to 28. Operations were started under the unit agreement of Kettleman North Dome Association on April 1, 1931.

The total amount of oil produced, during the 17 months of the shut-in agreement, by Milham, Continental, and Standard from wells in the discovery group was 5,297,262.22 bbls. The total amount paid out in "drainage" contributions was $2,046,048.18, representing sales value of 1,266,044.06 bbls. of oil.

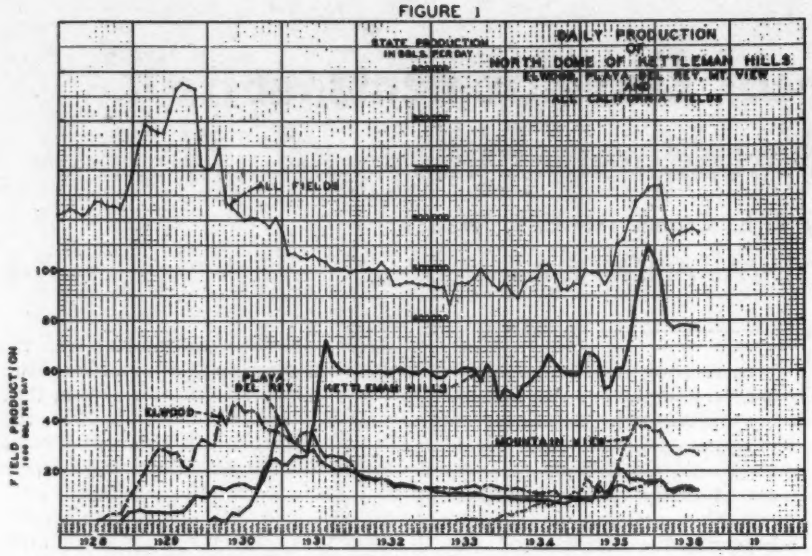
The shut-in agreement was unquestionably effective. Much oil was kept off the market and "drainage" was compensated liberally, principally by Milham Exploration Co. and Continental Oil Co. Standard Oil Co. had about 50% of the qualifying wells scattered around the field whose participation in the fund about offset the amount paid out by Standard Oil Co. from its producing wells.

Initials Not Reduced

An examination of the record will show that there was no material reduction in the initials of wells that were completed within the productive area subseqquent to the termination of the conservation agreement. Several wells that participated were at a considerable distance from the discovery group. At least one well, Bolsa Chica Ferguson 1, was a dry hole.

It is easy to see that if all the wells had been put on production the price of oil would have been 25 cents to 50 cents per barrel instead of a top of $1.65. Two million dollars, the total amount distributed, would buy 8,00,000 bbls. of oil at 25 cents

FIGURE 1



per barrel, which is more oil than the discovery group produced by 2,750,000 bbls.

The principal issues of the above episode were production control and drainage. They continue to be the active issues in Kettleman.

Kettleman Unitization

Paragraph 3 on page 4 of the agreement of July 25, 1929, reads as follows:

"In line with the Government's policy of oil conservation, to which this agreement contributes, the parties interested in the Kettleman Hills field undertake, by the appointment of a representative committee or by other means, to consider a plan of unit development or other cooperative method of developing this great structure with a maximum of production and utilization at a minimum of operating cost; such committee to report its progress from time to time to the Secretary of the Interior, and when deemed opportune, the Secretary will propose the necessary legislation enabling the Government's participation in the proposed cooperative plan, by authorizing both the necessary acreage involved and the substitution of a fixed and definite share in the output in lieu of the existing different rates of royalty for primary and secondary leases."

On Feb. 12, 1930, a meeting of the operators of the North Dome of Kettleman Hills was called. The above quoted portion of the shut-in agreement of July 25, 1929, was read. The operators then formally appointed a committee for the purpose of "studying all plans on the orderly development and production operations of the North Dome at Kettleman Hills." This became the Kettleman North Dome Committee which drew up the unit agreement of Kettleman North Dome Association.

Two general plans were first considered. One was a unit plan; the other was a "cooperative plan." Opinion rapidly crystallized in favor of a unit plan. At a meeting of the Committee on Mar. 19, 1930, the following telegram from then Secretary of Interior, Ray Lyman Wilbur, struck the key note of the effort and the broad scope of the project:

"I congratulate your committee on the skill and thoroughness shown in the plans being considered. The guiding principle of equitable treatment to all interests large or small is evident and these interests should meet you in a broad spirit looking to the adjustment of minor differences.

"Under the unit plan which I prefer, all parties will benefit through the considerable savings in costs both of development and of operation which may confidently be expected and the larger profits possible through this smaller capital expenditure and also by reason of the increased recovery with minimum physical and economic waste. Since the Government as a landlord will share in these larger returns and the public greatly benefit by the general conservation of oil and gas I assure your committee of the department's hearty cooperation within statutory limitations.

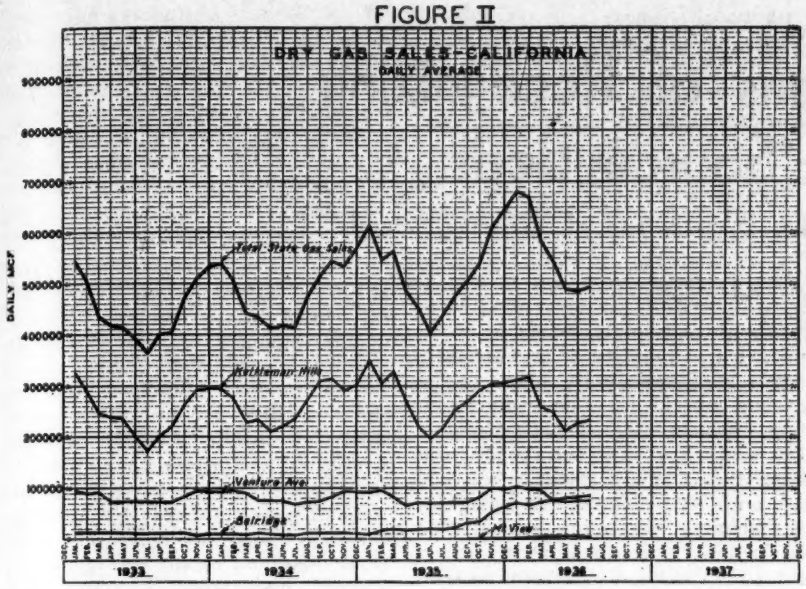
"Since the full utilization of this great gas reserve is the most important item in any program intended to serve best owners and public alike I strongly endorse your statements relating to the possible effects of the gas law and your finding that under that law Kettleman Hills could only produce oil with a schedule of production which makes a startling comparison with the schedule proposed previously but considering the large potential supply of oil in the state recoverable with low gas oil ratio and the fact that drastic curtailment must be made in older fields in order to share the market with Kettleman Hills field it is not likely that should the gas law be held constitutional state authorities would permit the wasting of natural gas from Kettleman in order to meet an oil market readily suppliable from other curtailed fields."

"Answering your specific questions I appreciate that the proposed plans are rational because they substitute for the expensive and wasteful drilling of offset wells the equitable sharing by the undrilled acreage in the production from the area as a whole. This necessitates some adjustment of the present method of collecting the Government royalty. The rate of royalty is already fixed for the A lease and I agree with you the B rate should preferably be a determined and uniform rate since it is obvious that this rate cannot be dependent on productivity of wells on the individual lease the drilling of which might be deferred to the last years of the program.

"The department now has under consideration for submission to Congress an amendment to Section 27 of the leasing act for the purpose of authorizing government participation in cooperative or unit plans with specific authority 'to modify drilling producing and royalty requirements'. I regard this as necessary to protect the Government's own interest, assure the savings possible, prevent waste and promote the share and share alike principle of the unit plan and I believe that this amendment will meet the necessities of Kettleman Hills and at the same time avoid many complications which would arise from an attempted revision of the general terms of the Leasing Law.

"In the second place I realize that any conservation plan includes of necessity a program of slow development and production so that the life of the project necessarily exceeds the initial 20-year term of a government lease. However, in this connection particular attention is directed to Section 17 of the original Leasing Law granting lessee preferential right to renew for successive periods

FIGURE II



of 10 years upon reasonable terms and conditions. It is my carefully considered opinion that unreasonable or arbitrary terms and conditions sought to be imposed by a Secretary of the Interior would be subject to court review and I am confident that the court would protect lessee and his granted rights."

With this broad, idealistic purpose before it, the Kettleman North Dome Committee settled down to draft a unit plan for the North Dome of Kettleman Hills. All interests were represented. All interests, including Standard, Union, Superior, Shell, Associated, Petroleum Securities, none of whom finally subjected their fee acreage or leases to unitization, discussed freely and voted along with Government permittees on formulation of various conditions and covenants of the unit agreement.

Kettleman Location

Kettleman Hills, a long anticlinal structure, lies across the boundary line between Fresno and Kings county on the west side of the San Joaquin Valley. About 15 miles long and two miles wide, the field encloses about 16,500 acres of participating oil and gas lands. Of this acreage approximately 50% is unitized. The division of control is as follows:

	Acres	Per Cent
Kettleman North Dome Association	8,120	49.7274
Outside fee acreage—not including Standard fee..	540	3.2708
Total Standard Oil Fee	7,760	47.0018
Totals	16,510	100.0000

After 15 months of deliberation, the unit agreement of Kettleman North Dome Association was executed as of Jan. 31, 1931. In order to have some semblance of effectiveness as a unitization project it was necessary that some cooperative balancing arrangement be worked out with Standard Oil Co. of California. After a delay of several years such an arrangement is in effect. At one time also, Kettleman North Dome Association had under consideration the purchase or acquisition of control of acreage in sections 29, 35, and 36. This appeared necessary in order to prevent Kettleman being thrown into a competitive development situation. Many obstacles prevented this acquisition.

The Articles of Incorporation of Kettleman North Dome Association set forth the *purposes* of unitization as follows:

"The purposes of the corporation shall be to provide without profit to the corporation for the unified development and production of oil, gas and other hydro-carbons from the North Dome of the Kettleman Hills, Fresno and Kings counties, California, under agreement between the Secretary of the Interior of the United States and various owners of lands and/or persons operating or having right to develop and operate lands for production of oil, gas and other hydrocarbons therefrom within said North Dome of the Kettleman Hills, with the aim that ultimately each and every member shall have received his just share of products derived or revenues received from production and shall likewise have paid his just share of the expenses of winning said products and revenues, and to the end that there may be an orderly development of said North Dome Field so that there be ultimately recovered the greatest amount of oil, gas and other hydrocarbons with the least possible waste of such natural resources; to extract natural gasoline from gas produced by the corporation from the unified area, either in plants operated by it or under contract with others; to distribute oil, natural gasoline, gas and other hydrocarbons produced among its members in kind or on their order, and/or at the request of any member to sell any or all of such products for said member."

All Companies Interested

All major companies in California were interested in seeing some form of unitization put into effect in California. Several of them undoubtedly mistook production control for unitization. They were anxious to see unitization for the other fellow. Some of the smaller interests feared that acceptance of unitization would definitely provide an effective throttle to be applied to the potential production of this field, while other fields in the state enjoyed a greater proportionate share of the state's allowable.

That this possibility was recognized in other quarters is shown by the following quotation from a letter written to Wm. Reinhardt, Chairman of Kettleman North Dome Committee, by George Otis Smith, Director of U. S. G. S., on July 8, 1930. The occasion for the letter was the passage of unit operation amendments to the general Land Leasing Law:

"As unit operation touches upon limitation of production, reference of the matter to the Department of Justice was necessary. First of all, there appeared to be little in common between our two views of the subject: desire for efficiency, economy, and conservation on the one hand; fear of monoply, restraint of trade, and a higher price for gasoline on the other."

All of the necessary safeguards were placed in the unit agreement so as to prevent monoply; to insure Kettleman a proper proportion of the state's production; to insure maximum production at minimum cost and to divide recovery of products on an acreage basis.

There was just one thing lacking —part of the acreage was not unitized. Government in its anxiety to perfect unitization forced its lessees

(Continued on Page 27)

Means of Recognizing Source Beds

By Parker D. Trask and H. Whitman Patnode

AS SOURCE BEDS are essential for the formation of an oil field, it is of distinct advantage to oil operators in exploring for oil to be able to recognize and evaluate such beds in the areas they intend to prospect. The U. S. Geological Survey and the American Petroleum Institute have for several years supported jointly an investigation of source beds. In this study several possible means of identifying mother rocks of petroleum have been considered. The method of attacking the problem has been to ascertain whether or not a relationship exists between certain characteristics of sediments and the ability of those sediments to generate oil. Simple characteristics, such as organic content and volatility, and ratios of these characteristics to one another (such as the carbon-nitrogen ratio) have been investigated first.

Many thousand analyses have now been made, and the object of the present report is to summarize the results obtained. However, as additional analyses are still being made, this article is not final—although sufficient analyses are now available to warrant pointing out certain generalizations. For more detailed descriptions of methods and results, the reader is referred to previous publications based on this study of source beds.[1a b]

Characteristics of Sediments

The characteristics of sediments discussed in this report are all relatively simple ones that can be readily determined with fair reliability. They also represent rather fundamental properties of the organic constituents of sediments. Eight characteristics are considered: 1, organic content; 2, reducing power; 3, color; 4, volatility; 5, degree of volatility; 6, carbon-nitrogen ratio; 7, oxidation factor; and, 8, nitrogen-reduction ratio. As all these characteristics, with the exception of color, have been described in previous publications about this work on source beds,[10] they are not described in detail in this paper.

[a] Figures refer to bibliograpry.

Organic Content

The most reliable means of determining the quantity of organic matter in a sediment is by means of the carbon content, C. The organic content of ancient (lithified) sediments is roughly 1.6 times the carbon content, and it ranges mainly between 1.4 and 1.8.[9] The carbon content (carbonates not being considered) is the most difficult of all the characteristics studied to determine with desired accuracy, and the analysis is more time-consuming. Up to the time of writing this report, it has been measured on about 2300 samples. Few determinations of carbon have yet been made from sediments from California and the Gulf Coast.

Reducing Power

Sediments have the ability to reduce substances such as chromic acid. In this process of reduction, oxygen is removed from the chromic acid and added to the constituents of the sediments. The number of cubic centimeters of 0.4-N chromic acid that can be reduced by 100 mg. of sediment has arbitrarily been taken as a measure of the reducing power (R) of a sediment. The reducing power has been found to be a rough index of the organic content, although the ratio of reducing power to organic content varies somewhat among different sediments. The reducing power is determined much more rapidly than carbon, and the individual determinations have a greater reliability. The reducing power has been determined on more than 6000 samples.

Color

Color has been regarded by numerous geologists for many years as a guide in recognizing source beds,[11] presumably because it was regarded as an index of the organic content of sediments. Dark sediments have been considered as being rich in organic matter, and light sediments as poor. The color of 1000 samples distributed representatively over the area investigated has been matched against a series of standard colors, so that the relationships of color to organic content and to the ability of the sediments to generate oil could be ascertained. Finely-ground samples of sediments were used in matching the color.

The essential thing measured was the intensity of color. Because of difference in hue, difficulty was encountered in matching the colors of the sediments. It was found necessary to have standards for intensity for each of several hues. The main hues observed in the sediments examined were grey, brown, green, yellow, red, bluish-grey, and maroon. Several grades of intensity from light to dark for each of these hues were selected. At first it was thought that a dozen color standards would be sufficient, but ultimately 37 were found advisable.

After the color standards had been chosen, the problem arose as to how to arrange them in order of increasing intensity. Sediments colored red and orange with iron oxide were particularly difficult to place in their proper position. Both authors arranged the color standards several times in what they thought was the proper order. As the coefficient of correlation[12] between these several rankings was found to be greater than 0.90, the method was regarded as a satisfactory basis of classification. The final arrangement of the order of colors was determined by a series of averages of the different rankings that had been made. A photograph of the standards in this order with panchromatic film showed a fairly uniform increase in intensity.

Volatility

The organic constituents of sediments contain volatile substances. A measure of the quantity of these volatile materials can be obtained by distilling a small quantity of the sediment in a narrow test tube. Tarry and oily substances accumulate on the upper walls of the tubes, and the quantity of such substances is estimated by comparison with known standards. Numbers ranging from 0.2 to 20 are used to indicate the amount of this tarry and oily material. These numbers are called "assay" numbers, and are designat-

In this A. P. I. paper, delivered at the recent Chicago meeting, the authors consider eight characteristics of sediments as possible means of recognizing source beds. (In Two Parts)

ed by the symbol A. Individual determinations are made with considerable rapidity, and can readily be duplicated. However, as all the volatile constituents do not collect on the walls of the tubes, the method affords only a rough determination of the volatility. The volatility has been determined on the 23,000 samples considered in this report.

Degree of Volatility

The volatility varies more or less directly with the organic content. Sediments that contain little organic matter generally have low assay numbers, and those that contain much organic matter have high numbers. But the organic constituents of sediments vary in the quantity of volatile material they contain. In order to measure this volatility relative to the total quantity of organic substance in a given sediment, the assay number is divided by the measure of the organic content. For example, if two sediments have assay numbers of 4, but one contains 2 per cent organic matter and the other contains 4 per cent, the volatility relative to the organic content of the first is 4/2 or 2, and of the second 4/4 or 1. The relative volatility of the first, accordingly, is double that of the second.

The ratio of the assay number to the carbon content, A/C, would be the most reliable index of the degree of volatility to use; but, as carbon has not been determined on as many samples as the reducing power, which is also a measure of the organic content, the ratio of the assay number to the reducing power, A/R, has been used in this report.

The degree of volatility cannot be determined with desired reliability in sediments that contain very small quantities of organic matter. The smallest assay number that can be distinguished is 0.2. If the assay number were determined as 0.2, a sample that contained 0.2 per cent carbon would have a degree of volatility of 0.2/0.2 or 1.0, and a sample that contained 0.05 per cent carbon would have a degree of volatility of 0.2/0.05 or 4.0. The second sample might not necessarily have a greater degree of volatility than the first, because the actual assay number might have been 0.04—in which case the degree of volatility would be 0.04/0.05 or 0.8. In the Gulf Coast many sediments were found to have assay numbers of 0.2 and carbon contents (as indicated by the reducing power) of less than 0.2 per cent. The sediments that contained the least amount of carbon, therefore, were calculated as having the greatest degree of volatility. As the proportion of sediments that had low assay numbers and low organic contents was large in this area, the averages of the degree of volatility that were calculated for units of sediments in this area are apt to be anomalous.

Carbon-Nitrogen Ratio

The carbon-nitrogen ratio, C/N, is an index of the proportion of nitrogen in the organic matter. If the ratio is high, the proportion of nitrogen is small; and, if the ratio is small, the proportion of nitrogen is large (provided, of course, that the proportion of carbon in the organic matter is constant). For example, if the carbon content of two sediments is 1.0 per cent and the nitrogen content of one is 0.05 per cent and of the other 0.07 per cent, the carbon-nitrogen ratios are 1.0/0.05 or 20, and 1.0/0.07 or 14, respectively. Because the carbon-nitrogen ratio of sediments in a particular area ordinarily does not vary widely, the percentage of nitrogen in the sediments (being thus related to the primary index, C) can be taken as a crude index of the organic content of the sediments. Nevertheless, the ratio varies through an appreciable range in each area, and the variations seem sufficiently significant to be investigated with respect to their relation to the productivity of the beds.

Oxidation Factor

The oxidation factor, C/R, is the ratio of the carbon content of the sediments to the reducing power. It is a rough index of the oxygen content of the organic constituents of sediments. As petroleum consists of compounds deficient in oxygen, the organic substances from which it is generated may also be low in oxygen. Although the reducing power is a measure of the ability of the sediments to reduce chromic acid, it can also be regarded as a measure of the ability of chromic acid to oxidize the sediments; for, when one substance is reduced, something else has to be oxidized. Both organic and inorganic constituents of sediments are oxidized by chromic acid, but the reducing power is so closely related to the organic content that it seems obvious that most of the substances reduced are organic constituents.[13] Variations in the oxidation factor, i.e., variations in the ratio of the carbon content to the reducing power, accordingly indicate roughly variations in the state of oxidation of sediments. The more chromic acid needed to oxidize the sediments of given carbon content, i.e., the smaller the ratio of carbon to reducing power, the lower is the state of oxidation of the sediments. For example, if two sediments have an organic content fo 1.0 per cent, but one has a reducing power of 1.25 and the other has a reducing power of 1.00, the first requires 1.25 units of chromic acid to oxidize the sediment, and the second requires 1.00 unit. The first sediment, accordingly, needs $\frac{1.25-1.00}{1.00}$ or 25 per cent more chromic acid to oxidize its organic constituents than does the second. The first sediment, accordingly, has a lower state of oxidation than the second. The oxidation factor of the two sediments is, respectively, $\frac{1.00}{1.25}$ or 0.80, and $\frac{1.00}{1.00}$ or 1.00. Low oxidation factors, therefore, indicate a low state of oxidation of the sediment. The oxidation factor, consequently, is a rough index of the oxygen content of the organic constituents.

Nitrogen-Reduction Ratio

The nitrogen-reduction ratio (N/R) is the ratio of the nitrogen content to the reducing power. It is similar to the oxidation factor (C/R) except that nitrogen has been substituted for carbon. Because the nitrogen content is a rough index of the organic content of sediments, the nitrogen-reduction ratio, therefore, is a crude index of the degree of oxidation of the sediments. Like the oxidation factor, low ratios indicate a low state of oxidation. The nitrogen-reduction ratio is also desirable to study on its own merits, aside from its relation to the state of oxidation. Its usefulness as a thing to study is further enhanced by virtue of the relative ease and rapidity with which it can be determined. This ratio has now been determined on about 5,000 samples.

In order to ascertain whether or not any particular characteristic of

sediments may be of use in identifying source beds, some basis of classifying sediments as to their ability to generate oil has to be available. It is more reasonable to assume that oil generally accumulates somewhere near where it is generated than to assume that it usually collects a long distance from where it is made. Nearness of sediments to known oil zones, accordingly, may serve as a basis for classifying sediments as source beds. Nearness to oil zones, however, is not an infallible criterion; because, in some fields, oil has surely accumulated at a considerable distance from where it originated. For example, in the Garber field in Oklahoma, oil is found in some zones that are barren in other fields in that general area. Apparently the oil came from horizons stratigraphically remote from the places in which it is found. Also in the East Texas field, the chances are good that much oil migrated for a considerable distance up the flanks of the East Texas Basin toward the field. Moreover, sediments may vary in character within stratigraphic units. Units of sediments relatively near oil zones, may contain layers that are poor in source material; and other units which are far from oil zones, and which as a whole have generated little oil, may contain layers rich in source material. Also different units of sediments which have a similar ability to generate oil, and which are at equal distances from reservoirs, may have yielded different amounts of oil to the reservoirs, owing to different opportunities for migration of the oil.

A classification of sediments as source beds based upon the nearness to oil, accordingly, must be expected to yield some anomalous results. The proportion of anomalous results can be considerably reduced if large numbers of samples from many areas are studied, and if averages of comparatively thick units of strata are considered.

For the purpose of this report, the sediments have been segregated into three classes with respect to nearness to oil zones: 1, sediments near oil zones; 2, sediments at intermediate distances; and, 3, sediments far from oil zones. A classification of this sort gives some assurance that the sediments in the first class are, in general, richer in source material than those in the third class—provided, of course, the basic assumption that oil ordinarily accumulates near its source is correct.

An attempt has been made to set arbitrary limits of distance for these three classes: Class 1, sediments within 250 ft. stratigraphically above and below an oil zone and less than 2 miles from an oil field; class 2 (a) sediments lying between 250 ft. and 500 ft. stratigraphically above or below an oil zone and less than 2 miles from an oil field, (b) sediments within 500 ft. above or below an oil zone and between 2 and 15 miles distant from an oil field, (c) sediments within 250 ft. above or below an oil zone and more than 15 miles distant from an oil field in areas where that particular oil zone is generally productive, and (d) sediments less than 250 ft. above or below a zone whose sediments yield significant quantities of oily substances when extracted with ether; class 3, all other sediments, viz., those lying more than 500 ft stratigraphically above or below an oil zone and sediments more than 15 miles distant from an oil field, except those situated less than 250 ft. above or below a zone that usually yields oil in the general region or whose sediments contain significant quantities of oily substances soluble in ether.

These vertical or stratigraphic limits have not been rigidly adhered to, because an attempt was made to consider the lithology in classifying the sediments with respect to their ability to generate oil. For example, when the stratigraphic limits of 250 ft. or 500 ft. came within a unique lithologic unit, such as the Chattanooga shale, the entire unit was classified as belonging to the same class.

COMPILATION OF DATA

Averages Used

In order to make the results more representative, averages instead of individual determinations have been used in compiling the results. Medians in preference to means have been used in making the averages, because they are believed to represent more closely the real conditions. The median represents the midpoint of a series of determinations. One-half the determinations are larger than the median, and one-half are smaller. The median and the mean ordinarily do not differ greatly, but the median is especially satisfactory for averaging ratios, and it is less likely to be affected by anomalously high or low determinations than is the mean. The advantage of the median is illustrated by the following example: if the seven determinations that are to be averaged are 1.0, 1.1, 1.1, 1.3, 1.3, 1.4, and 5.0, the median—which is 1.3—gives a more reliable indication of the most prevalent determination in this series than does the mean—which is 1.8.

For the assay numbers, however, the mean was used instead of the median, because a quantitative measure of the amount of volatile substances was desired rather than the most prevalent assay number. In several areas the median assay number was 1.0; but in some of the areas a considerable proportion of the sediments had assay numbers of 2 or 3, and in other areas an equal proportion had numbers of 5 or 6. The sediments in the latter areas were clearly richer in volatile substances than in the former. The median would not indicate this difference, but the mean would indicate it definitely.[14]

In studying the relationship of the characteristics of sediments to the potentiality of the sediments as source beds, the determinations for the individual samples have been averaged for formational or lithologic units for each well investigated. The numbers and distribution of the samples averaged are presented in Table 1. Formations or lithologic units greater than 500 ft. thick were ordinarily divided in approximately equal parts, so that no lithologic unit would be more than 500 ft. thick; but some units that were represented by few samples were average for each 1,000 ft.

The average numerical value for each characteristic for each stratigraphic unit was then plotted against

TABLE 1
Number of Samples Studied

Area	Total Samples	Analysis: Carbon	Analysis: Reducing Power	Analysis: Nitrogen	Sequences of Sediments Considered
	Number				
California	7,490	261	1,646	1,657	167
Rocky Mountain	3,312	641	965	938	105
Mid-Continent	6,387	983	1,828	975	259
East Texas Basin	3,311	410	1,433	861	241
Gulf Coast	2,440	0	738	380	73
Total	22,940	2,295	6,610	4,811	845

TABLE 2
Size Distribution of Degree of Volatility in California

Productivity	Degree of Volatility									Total
	1.0-	1-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3-3.5	3.5-4.0	4-4.5	4.5-5	
Productive	..	2	16	12	14	13	9	3	2	71
Questionably productive	5	3	4	14	16	8	5	2	2	59
Barren	7	9	9	7	3	1	..	..	1	37

the three grades of productivity for each of the five areas considered—California, Rocky Mountains, Mid Continent, East Texas, and Gulf Coast. The method of plotting is illustrated in Table 2, which shows the relationship of the productivity to the degree of volatility (A/R) for California sediments. After the data had been arranged in this way, the median and its probable error for each of the three grades of productivity were determined for each of the five regions. Characteristics involving the carbon content were not included for California and the Gulf Coast, as the necessary carbon determinations have not yet been made.

Reliability of Averages

The probable error is an inverse measure of the reliability of a determination, such as any of the averages in this report. The smaller the probable error, the more reliable the determination. The probable error varies inversely with the square root of the number of units involved. Consequently, the greater the number of units, the more reliable is the determination. The probable error does not indicate the total range in which the true value of the determination probably lies; it indicates the range in which one-half the determinations would probably lie if a determination were repeatedly measured. For example, if a determination and its probable error are 10.00+—or—1.0, it means if the determination were measured again several times, one-half the measurements would probably be within 1.0 of 10.0, i.e., between 9.0 and 11.0 and one-half the measurements would be outside these limits, but ordinarily not more than 4.0 times the probable error, viz., not less than 6.0 or greater than 14.0.

The probable error of the determinations in this report represents the quotient of the semi-interquartile range and the square root of the number of units involved.[15] The semi-interquartile range is one-half the difference between the two quartiles. If the units involved in the determination are arranged in order of magnitude, 25 per cent are greater than one quartile and 25 per cent are less than the other quartile. Thus, in Table 2, for the "productive" group the two quartiles are 3.33 and 2.02. The semi-interquartile range is one-half the difference between the quartiles, viz., $\frac{3.33-2.02}{2}$ or 0.655. The number of units is 71. The probable error, accordingly is $\frac{0.655}{(71)^{1/2}}$ or 0.078. The median and its probable error, therefore, are 2.70+or—0.078. Similarly, the median and probable error of the "barren" group is 1.67+or—0.80. The difference between the medians of the "productive" and "barren" sediments is 1.03. The probable error of this difference is the square root of the sum of the squares of the probable error of the two medians, viz., $(0.078^2+0.080^2)^{1/2}$ or 0.112.

The quotient of the difference and its probable error are used to indicate whether or not the difference is a real difference, and not due to errors in sampling. If the quotient is 1.0, the chances are even that the difference is real; if it is 2.0, the chances are 4.5 to 1 that the difference is real; if it is 3.0, the chances are 22 to 1; and, if it is 4.0, the chances are 142 to 1. Accordingly, any quotient greater than 4.0 can be regarded as indicating that the difference is not due to errors in sampling and, hence, probably is a real difference. In the example given in Table 2, this quotient is $\frac{1.03}{0.112}$ or 9.2. The difference, therefore, almost certainly is real.

Even if the quotient is less than 4.0, the difference may also be real, provided that the quotient is consistently positive or consistently negative in each of several areas. For example, if the quotient for the difference and its probable error between "productive" and "barren" beds for a particular characteristic, such as volatility, should be 1.0 in each of the five areas—California, Rocky Mountains, Mid Continent, East Texas, and the Gulf Coast—the chances that the particular characteristic will be greater for the "productive" beds than for the "barren" would be the same as the chances against throwing a coin heads five times in succession, viz., 31 to 1, or rather large. If the quotient of the difference and probable error were 2.0 in each of the five areas, the chances would be $(1+4.5)^5$—1.0 to 1, or about 5,000 to 1, or virtual certainty. If the quotient of the difference and probable error in some areas was positive and in other areas was negative, or if the difference was consistently less than 1.0, the chances would be small that the difference was distinctive; in fact, there would be reason to believe that the particular characteristic would be essentially the same in "productive" as in "barren" beds.

RESULTS

Organic Content

As petroleum is derived from the organic constituents of sediments, the total quantity of organic matter in sediments might be regarded as an index of the ability of the sediments to generate oil. The data for the carbon content, which is an index of the quantity of organic matter in the sediments, however, do not support this concept. The average carbon content of the "productive" and "barren" sediments is approximately the same in each of the three areas for which data are available (Fig. 1). In the Rocky Mountain area the average carbon content of the "productive" and "barren" sediments are 1.42 and 1.46 per cent, respectively; in the Mid Continent, 0.67 and 0.68 per cent, respectively; and in the East Texas Basin, 0.91 and 0.89 per cent, respectively. The quotient of the difference between the productive and barren areas and the probable error of the difference range from —0.2 in the Mid Continent to 0.6 in the East Texas Basin. The differences in sign and the small magnitude of the quotient indicate that the carbon contents of the "productive" and "barren" sediments are approximately the same in these areas.

Reducing Power

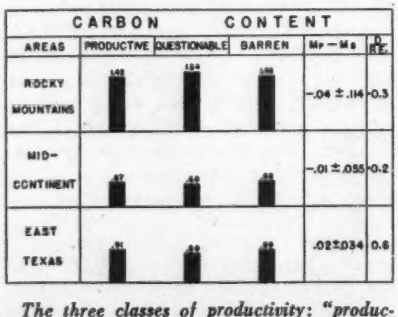
As the reducing power is a rough index of the carbon content, the data for it may be used to indicate whether or not the organic content of the sediments from California and the Guf Coast (which have not yet been analyzed for their carbon content) is related to the potentiality of the sediments as source beds. The problem of applying data about the reducing power to the sediments from these areas, however, is complicated by the possibility that the reducing power may be a better index of the ability of the sediments to generate oil than is the carbon content. For

sediments from California, the Mid Continent, and the Gulf Coast the quotient of the difference between the average reducing power of the "productive" and "barren" sediments and the probable error of the difference ranges from 2.7 to 4.5 (Fig. 2), which would seem to indicate that the "productive" beds tended to have a greater reducing power than the barren beds; but in the Rocky Mountain and East Texas areas the averages of the "productive" and "barren" beds are essentially the same. In view of the conflicting tendencies of the results from the five areas studied, it must be concluded that the reducing power is not consistently different for "productive" and "barren" beds, although in some areas there is a decided tendency for it to be greater in the "productive" than in the "barren" beds.

On the assumption, however, that the reducing power is related to the organic content in the same way as is the carbon content, a chart can be compiled which will show the distribution of sediments with respect to organic content for each of the three grade of productivity (Fig. 3). In this chart the organic content has been calculated as 1.6 times the carbon content where data for carbon are available, and 1.6 times the reducing power where no data for carbon are available. Fig. 3 is divided into two parts: on the left side, the organic content is plotted

FIG. 1

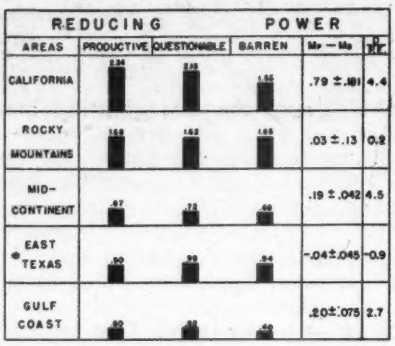
Relation of Carbon Content to Productivity of Sediments



The three classes of productivity: "productive," "questionable" (or "questionable productive") and "barren," represent the classification of the sediments as to favorable, questionably favorable, and poor source beds, respectively. Numbers above black blocks indicate average (median) percentage of carbon for individual grades of productivity. Height of blocks is proportional to the numbers above the blocks. Mp—Mb *represents the difference between the averages for the "productive" and "barren" sediments, together with the probable error of the difference.* $\frac{D}{P.E.}$ *indicates quotient of difference and its probable error.*

FIG. 2

Relation of Reducing Power to Productivity of Sediments



Figures above blocks represent average productive power for the individual grades of productivity.

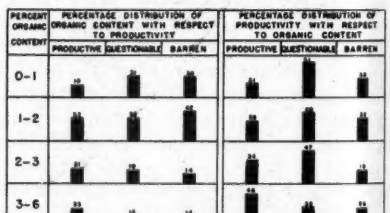
against the productivity; and on the right side, the productivity is plotted against the organic content. On the left side, the numbers above the blocks in each column add to 100 per cent. For example, in the first column these numbers indicate the percentage of all the units of sediments classified as productive that fell into different categories of organic content. Thus, 18 per cent of all the units which were classified as "productive" had an average organic content of less than 1 per cent; 32 per cent of all the "productive" units had an organic content of 1 to 2 per cent; 21 per cent, an organic content of 2 to 3 per cent; 25 per cent, from 3 to 6 per cent; and only 4 per cent had an organic content more than 6 per cent. On the other hand, 30 per cent of all the beds that were classed as "barren" had an average organic content of less than 1 per cent; 42 per cent had an organic content of 1 to 2 per cent; 14 per cent had an organic content of 2 to 3 per cent; 14 per cent, an organic content of 3 to 6 per cent; and none contained more than 6 per cent organic matter. Sediments low in organic matter, therefore, exhibit a slight tendency to be associated with "barren" beds, and sediments high in organic content show a tendency to be associated with "productive" beds. However, both "productive" and "barren" beds are well represented among the sediments that contain little organic matter and among those that contain much.

The distribution of productivity with respect to organic content is illustrated in another way on the right side of Fig. 3. In this figure the numbers above the blocks in each row add to 100 per cent. Thus, of all the lithologic units that had an average organic content of less than 1 per cent, 21 per cent were "productive"; 51 per cent were "questionably productive"; and the remaining 28 per cent were "barren." Of all the units that contained 1 to 2 per cent organic matter, 28 per cent were "productive"; 40 per cent, "questionably productive"; and 32 per cent were "barren," etc.

For each successively higher percentage of organic content, the proportion of beds that were "productive" increases. This increase is illustrated by the increase in size of the black blocks from top to bottom in the first column on the right half of Fig. 3. In other words, the rich sediments exhibit a tendency to be associated more commonly with productive than with barren units. Nevertheless, a significant proportion (21 per cent) of sediments that contain less than 1 per cent organic matter are "productive," and an equally significant proportion (28 percent) of sediments that contain 3 to 6 per cent organic matter are "barren." The quantity of organic matter in sediments, therefore, in all probability has little value as an index of source beds—despite the fact that beds very low in organic content show some tendency to be poor source beds, and sediments very high in organic content show some tendency to be good source beds.

FIG. 3

Relation of Organic Content of Sediments to Productivity



On the left side of figure, the five numbers above the blocks in each of the three columns add to 100 per cent. In the first column the numbers indicate the percentage distribution of all sediments that were classed as "productive"; in the second column the numbers indicate the percentage distribution of all sediments that were classed as "questionably productive"; and in the third column, the distribution for the "barren" sediments. On the right side of the figure, the three numbers in each of the five rows add to 100 per cent. In the first row the numbers represent the percentage distribution of all sediments that contain less than 1 per cent organic matter; in the second row they refer to the distribution of sediments that contain between 1 and 2 per cent; in the third column, to sediments that have 2 to 3 per cent, etc.

Part 2 will appear in next week's issue.

Production

New Wildcat Starts Near Alamitos After Land Explored With Seismograph

AFTER A THOROUGH seismographic exploration, the Calmont Oil Co. is preparing to drill a new wildcat in the nw¼ sec. 14, 4s-12w, in the Alamitos area, about a quarter of a mile southeast of the intersection of Carson St. and Woodruff Ave. The land is held in the name of the Montana Land Co., which is headed by Clark J. Bonner. Paul H. Talbert will handle the details of the Calmont Oil Co., however, the head offices of which are in Los Angeles. A permit to sell stock has been granted the company.

Ascot Park

Republic Petroleum Co.'s wildcat at Ascot, Jordan No. 1, ran a formation tester during last week, and recovered oil showings. The company's present plans are to core ahead and determine the exact thickness of the formation entered at 1405 ft. with the present bottom at 1486. The 81 ft. thus far uncovered are about two-thirds oil sand and one-third shale, the sand reasonably light.

Wilmington

General Petroleum Corp. has been unable to effect a satisfactory water shut off because of about 500 ft. of heaving sand. The company is cleaning out the hole with the drill pipe, with 13-inch casing cement at 2495 ft.

Terminal No. 1 lost a perforator in the hole about 10 days ago, and is still fishing for it and its sand line.

Royalty Service Corp. has made a location for its Community No. 1, an offset to General Petroleum's Patton No. 1.

Sunset Oil Co.'s Lupie No. 2 is on production, having been completed Nov. 22, at 3559 ft., with 8-inch casing cemented at 3291 ft. and is making about 78 bbls. per day on the pump. The oil is 14-gravity, with a 22% cut of sand and mud.

Gauthier Oil Co's No. 1 is pumping 75 bbls. per day.

Huntington Beach

M. M. McCallen and associates have taken a three-acre lease from the Southern California Drilling Co. and are erecting a derrick on it.

The Hubro Oil Co. has taken over the Bruce Bros. well at 16th and Ocean and will redrill it to 4660 ft.

Richfield Oil Co. is building a derrick to drill a new well at Golden West Ave. and Ellis Ave.

The Ruchti Bros. Petroleum Co., a new company headed by Earnest Ruchti, who operates a meat packing plant, has graded a location for a well on Delaware Ave.

The Vicaroo Oil Co's. S & G No. 1A is drilling in oil sand at 4205 ft. The well is in the town-lot area.

Hammil Oil Corp. has redrilled its Lewis No. 2A to 4075 ft. and has cemented 9-inch casing at that point.

The Texas Co. is preparing to run 8-inch casing in its Brown No. 4, with bottom at 4027 ft. The casing probably will be set at about 3800 ft.

South Basin Oil Co. has its No. 93 standing cemented at 3990 ft.

H. S. Kohlbush is drilling in oil sand and shale at 4205 ft. He obtained a shut off at 4144 ft. on 8-inch casing.

Torrance-Redondo

The O. S. Oil Co., formerly the Severns Drilling Co., is planning to start a second well on its lease at Main and Lomita. The company's first well was redrilled to 3708 ft. and will make a production test. The well has 272 ft. of liner, including 143 ft. of perforations, landed at 3708 ft. and cemented through perforations at 3565 ft.

The C. C. M. O. Co. has plugged its Redondo No. 2 to 3235 ft., after coring the top of the conglomerate at 4311 ft. and the top of the schist at 4343. The well was plugged because the conglomerate gave indications of being wet.

The Hunt Oil Co. is building a derrick to redrill the old Fullerton No. 1, near the Dearborn well at Hawthorne Ave. and Sepulveda Blvd.

Other Basin Fields

The Superior Oil Co. is coring at 8807 ft. in its Inglewood Extension No. 1, with no showings reported. The well is in Fox Hills, sec. 25, 2-15.

If Richfield gets commercial production in its El Segundo No. 1, The Texas Co. will start a well. The El Segundo well is standing with the 7-inch cemented at 7322 ft., and will test approximately 103 ft. of conglomerate for production.

■ ■ ■

Dumas-Lewis Shut Off O. K.

Dumas-Lewis No. 3 at Beryl and Flagler, East Redondo, has been given approval on its water shut-off at 3245. This hole is scheduled to be bottomed at 3640 ft., the approximate depth of producers on the opposite side of Flagler Avenue.

■ ■ ■

Lester Callahan, president, Wood-Callahan Oil Co., has a private license to fly his new five-passenger Wright-Waco biplane, now being housed at the municipal airport in Long Beach. Mr. Callahan bought the ship some months ago. It is capable of 175 miles per hour, and he plans to use it to get to and from the various districts where his company is prospecting for oil.

All Statistics And Reports Show Drilling Activity Moving To Valley

MOVING of the center of drilling activity from the Los Angeles Basin to the San Joaquin Valley and Coast fields is indicated by the daily and weekly California Oil World reports, the daily press reports, and the A. P. I. monthly statistics covering all California fields.

October A. P. I. data show that in the proved San Joaquin Valley fields there were 64 new rigs and 101 wells drilling during the month. The above number of drilling rigs was exactly twice the number in the Los Angeles Basin and the Coast proved fields. The Los Angeles Basin had 19 rigs, the Coast 13, and the number of new wildcats was 10. Thus the San Joaquin Valley had 50% more new rigs than other proved and unproved oil fields. There were three new rigs in the gas fields. The San Joaquin Valley's 101 drilling wells exceeded, by four, the combined total of the Los Angeles Basin and the Coast proved fields. There were 49 wildcats classified as drilling, but some were probably idle, either permanently or temporarily.

In the number of October completions, the San Joaquin Valley had 45, the Coast two, the Los Angeles Basin 21, giving the San Joaquin practically double the rest of the state. In initial output also, San Joaquin Valley came first with 19,542 bbls., more than twice that of the rest of the state. The Los Angeles Basin had 8477, the Coast 674 bbls. San Joaquin Valley had 5813 producing wells, 821 more than the rest of the state. Los Angeles Basin had 3783, the Coast 1209 wells.

Of California's total October production, San Joaquin Valley was responsible for 8,234,731 bbls., the Coast fields for 1,927,506, and the Los Angeles Basin for 7,779,793; total 17,942,030 bbls.

Contrast with October, 1935

Of the new rigs in October, 1935, 40 were in San Joaquin Valley, six on the Coast and 14 in the Los Angeles Basin. In other words, the San Joaquin Valley and the Coast fields increased their number of new rigs, the Valley by 50%, the Coast doubled its number with one to spare. The Valley had only 46 drilling wells during October, 1935, against 101 the same month this year, the Coast had 32, the Los Angeles Basin 78. This year the Coast had 47 and the Los Angeles Basin 50. In other words, the Coast had 50% more wells drilling during October 1936 than it had during the same month last year. In the Los Angeles Basin the number of wells drilling during October, 1936, was almost 50% less than last year.

During October, 1935, the Valley completed 32 wells against 45 this year, the Coast six against two this year. The Los Angeles Basin completed 46 wells during October, 1935, against only 21 this year. On the other hand, San Joaquin Valley's October initial production last year was nearly double what it was this year. Last year's big October yield was due to the bringing in of four Kettleman North Dome wells with an aggregate of 11,415 bbls. This year, October saw only one North Dome well brought in with a production of 1324 bbls.

Wider Spread

This year new drilling in San Joaquin Valley is spread over more fields than during last year. North Dome is very active but less so in drilling than it was during October, 1935 when it had 21 wells drilling, and seven new rigs up, against only 17 drilling wells and eight new rigs this year. But last year, October witnessed only six new rigs and six drilling at Midway-Sunset, this year the drilling wells numbered 24, the new rigs 17. Kern River reports 12 new rigs and 12 drilling wells this year against eight rigs and four wells last year. Fruitvale had five ne rigs and nine wells drilling this year against one new rig and three drilling wells last year. Round Mountain had five new rigs and five wells this year against none during October, 1935. The only field in the Valley which shows a decline in drilling activity is Mountain View, which reported only 12 wells drilling during October, 1935, against 21 last year. However, developments during November have started this field towards a comeback.

Los Angeles Basin Drilling

During October, 1935, Long Beach reports 38 wells in course of drilling and three new rigs. This year during October the same field reported one new well drilling and no new rigs at the end of the month. This field was thus responsible for half the drilling of October last year and is out of the picture entirely during October this year. There are a number of indications now, however, that Long Beach will show activity in the immediate future.

While it is thought of as being quite an active field, Montebello reported only five wells for October against 11 for October, 1935 Huntington Beach is coming back with seven drilling wells and six new rigs and some additions during November.

Proration Being Observed

Both the San Joaquin Valley and the Los Angeles Basin have reduced their output by voluntary restrctions by more than 1,000,000 bbls. as between October, 1935, and the same month of 1936. The smaller production of the Coast has been reduced nearly 100,000 for the same months. It may be noted that of the Valley's share of the voluntary cut, more than 20,000 bbls, per day or 600,000 per month comes from the North Dome, all controlled by major interests; 5000 per day, or 150,000 per month from Coalinga, largely in major hands; and 15,000 per day, 450,000 per month, from Mountain View. On the other hand, it should be noted that North Belridge is entirely in the hands of major companies, and it has increased its output by fully 5000 bbls. per day. Coast cuts have been at Elwood and Ventura Avenue, both controlled by the bigger companies.

In the Los Angeles Basin, on the other hand, Dominquez, a major controlled field, has gone up nearly 4000 bbls. per day, and Long Beach and Santa Fe Springs are down, the former 12,000, the latter 10,000 per day, and both are largely townlot areas.

■ ■ ■

Ventura Well Producing

Associated has a new well good for an initial yield of 890 bbls. per day at Ventura Avenue in its V. L. & W. No. 30, bottomed at 6872 ft. and cemented at 6867. The oil is 28 gravity, with the initial cut of 5% rapidly being reduced. The gas yield is comparatively small, 798,000 c.f. The new well extends production some 400 ft. southeast.

■ ■ ■

Hobson B-9 Recements

C. C. M. O. Hobson No. B-9, Rincon, has located its water trouble at 4510 and will recement. Bottom is at 4685.

Indications Strong That Shell Co. Leases Cover 10 Sections Structure; Ohio Quits

AS TIME GOES ON and other companies drill to lower levels in the 10 Sections area, indications are becoming more and more definite that Shell Oil Co. has the whole structure under lease. Shell has the only producers in the area, and Standard, Ohio, and Superior wells are not encouraging, the Ohio's KCL-E1 being so discouraging, in fact, that it is being abandoned. The well went to 8852 ft. without encountering any oil showings. It was drilled on sec. 19, 30-26.

Standard's KCL No. 9-1 in sec. 34, 30-26, is drilling at 8141 ft. in hard gray shale, and KCL No. 10-1, in sec. 20, 30-26 is down 8698 ft. in sandy gray shale, neither of them having had any showings.

Superior Oil Co., is drilling at 7431 ft., in its KCL No. 8 in sec. 11, 30-26, with no showings to date. About the only showings any of the wells, other than those of Shell, have had have been gray shale, which is anything but encouraging.

In the Rosedale district, Standard's KCL No. 11-1 is down 7721 ft. in shale and gray sand.

Mountain View

Sheldon Oil Corp. is planning to start two wells in this area. They will be drilled on sec. 19, 30-22.

General Petroleum Corp. has made a location for its Feeport No. 1, southeast of the n¼ corner of sec. 19, 30-29.

Allied Petroleum's No. 20, and Mid-State Petroleum's No. 1, both in sec. 19, 30-29, have set and cemented 6-inch casing, the former at 5142 ft. and the latter at 4626 ft.

Mohawk's Hood No. 3, the deepest well in the immedate area, is drilling at 7470 ft. in sand and shale. The well is on sec. 30, 30-29.

F. A. Nighbert has acquired the 40 acres comprising the ne¼ne¼ sec. 30, 30-29, quitclaimed by Shell Oil Co. and is planning an immediate test of the area.

Arvin

A new well for the Arvin district is planned by Superior Oil Co., which has made a location for its Arvin Community No. 1, south and west of the center of sec. 26, 31-29.

General Petroleum is drilling at 7462 ft. in its Arvin No. 1, on sec. 26, 31-29. The formation is a hard conglomerate which is believed to be very near the basement formation. As soon as this last has been definitely determined, General Petroleum will run 7-inch casing and will test upper oil showings.

Shell has reperforated its Greer No. 1, sec. 15, 31-29, from 5746 to 6007 ft., but got no oil or gas on a swabbing test. The hole is being cleaned out.

Mohawk's Earl Fruit Co. No. 2 has not yet been able to get a shut off at 6070, even though the well was recemented last week.

Fruitvale

John C. Callahan plans to start a derrick for a well on sec. 21, 29-27 within the next few days.

Magnet Oil Co. should have the derrick started for another well on sec. 21, 29-27. The company's plans call for the drilling of nine more wells in the area.

Meridian Oil Co. is preparing to start its Dixon No. 1 and Turner No. 2, both on sec. 23, 29-27.

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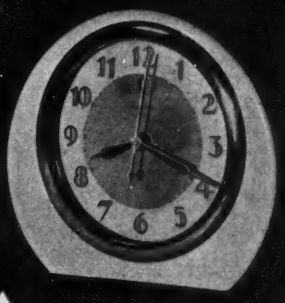

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East Side Of Kern County Active As New Wells, Wildcats Underway

DOYLE PETROLEUM has the material on the ground for a second test on the eastern part of the Quinn ranch near Jasmine where it has just drilled a test on sec. 15, 25-17, and has obtained enough oil, although not commercial quantities, to justify further prospecting. The depth reached was 2882 ft. and the cement job was done at 2829. The area is at the north end of the huge leases taken by Hall & Baker extending from here south to the Kern River Front for corehole testing, and since passed to the Shell Oil Co., which facts lend additional interest to the Doyle test.

J. J. (Jack) Doyle of Los Angeles and a few associates constitute the Doyle Petroleum Co., which is well equipped to carry on prospecting of this type.

New Test For Premier

David L. Roscoe and Carl S. Stanley have leased 320 acres in the northern part of the Premier area, and have erected the derrick for their first test, Newhope No. 1, on the se¼ sec. 29, 27-27, offsetting the Golden Bear's Grimes lease, where the Kern River zone should be found around 2800 ft. Success will extend the north limit of Premier's proved zone. Golden Bear's adjoining property has been only pratially drilled to date.

R. H. Gordon of Beverly Hills will drill a wildcat on an 80-acre tract, sec. 18, 28-28. The site has been graded and the Geisler Drilling Co. is expected to drill the hole.

Honolulu Oil Corp. has recently spudded in its No. 79, sec. 8, 28-27, Kern Front. The foundation is in for No. 88 and the rig is up for No. 59. Its No. 69 has been on production since Nov. 11 and after more than two weeks' operation is yielding 245 bbls., 15 gravity, 6% cut, as against 32% initial cut. All these wells are on sec. 8, where Honolulu is centering its heaviest operations.

General Petroleum has two new rigs up on the Young lease, sec. 14, 28-27, for its Nos. 37 and 42 respectively, and has its Young No. 39 pumping 210 bbls., 14.4 gravity, 4% cut. In the same section, G. P. has its Wetmore No. 15 cemented at 1700 and testing over the week-end. Its production should be known this week.

Seskayden Oil Co., just organized, has taken the property held in the name of Alvah M. Kaime, with whom is associated Wm. de Koch and others. This company has completed one 80-bbl. well, Sesnon No. 1, sec. 17, 28-27, on property leased from the Sesnon Oil Co., and has spudded in Sesnon No. 2, same section. The oil from No. 1 is 13.5 gravity, an excellent road oil and asphalt material.

Bishop Oil Corp. has obtained 150 bbls. from its Fano No. 10, at 2040 fet., sec. 23, 28-27, and its No. 11 is reported to be in oil sand at 1900 ft.

National Oil Co. has four wells underway on sec. 11, 28-27. Universal No. 3 has been rigging up and should be drilling this week, and Universal No. 4 has completed rig. Provident No. 4 is on the pump for a production test, depth 1848 ft. Grau No. 5 has had water trouble, the source of which has been located, and the hole, bottomed at 1638, plugged back 130 ft.

California Star Oil Co., one of T. A. O'Donnell's corporations, has returned to drilling after several years of inactivity. It is getting ready to spud in its first well on the Kern Front, sec. 22, 28-27.

Italo has found itself compelled to plug back from 2850 and redrill 2000 ft. in its Cauley No. 35, sec. 16, 28-27, the well recently reported as producing.

Evidence of revival of interest in the Kern Front may be found in the erection by Associated and Standard of one new rig each, the former its No. 52, on sec. 23, 28-27, the latter its No. 2-9, on sec. 9, 28-27. Kern River Oil fields has the rig up for No. 2B, sec. 25, 28-27, and E. B. Milburn is rigging up on sec. 10, 28-27.

Trico Oil & Gas Co., after drilling to 3154 ft. in its Rosan No. 1, sec. 36, 28-27, the greatest depth of any recent drilling in this area, has suspended operations but not yet abandoned the well.

Deep Test At Lerdo

Arkelo Petroleum Co. has the deepest test on the east side of Kern county, now down 6500 ft. in the Lerdo area, sec. 23, 28-26. So far it has reported no oil or gas showings and was last declared to be in brown shale.

Despite the small production obtained, the McVan area continues to entice new drilling because of the shallow depths at which the oil is found. Framac Oil Co. is the latest entrant and is spudding its No. 3 on the ne¼ sec. 22, 27-27, using a gasoline engine rotary, with Fred H. Macfarlane in charge. The Kern River sand is found at 1400 ft.

Just north of Framac's operations Alphonzo Bell is bailing to bring in his Fitzhugh No. 3, sec. 14, 27-27, bottomed at 1360, while California Western has developed a 27-bbl., 14 gravity pumper on sec. 23 immediately adjoining the Framac property.

Mt. Poso-Poso Creek

C. C. M. O. has drilled its Mon No. 3, sec. 26, 27-28, to 1532 ft., plugged to 1520, installed perforated liner and is about to start a pumping test.

E. J. Harp's Salisbury No. 1, has been brought in for only five barrels and a reported 90% cut. The well is on sec. 27, 26-28 and is bottomed below 1400 ft. It is not yet known what course the operator will now follow.

The Texas Co. spudded in its Vedder No. 11 last week, sec. 4, 27-28.

Petroleum Securities Murdock No. 2, sec. 34, 27-28, topped the Vedder sand at about 1650, is in oil sand and is standing cemented at 1640.

Sullivan & Brice of Santa Barbara have made a location for a new well on the se¼ sec. 33, 27-28.

Other Valley Fields

Harper and Lundberg are starting a shallow test, with a portable outfit, at Devil's Den. The location is on sec. 24, 25-19.

In the Alondra Park area, Standard's Badger No. 1 is drilling in gray sand with shale streaks at 7420 ft. The well is on sec. 22, 3-14.

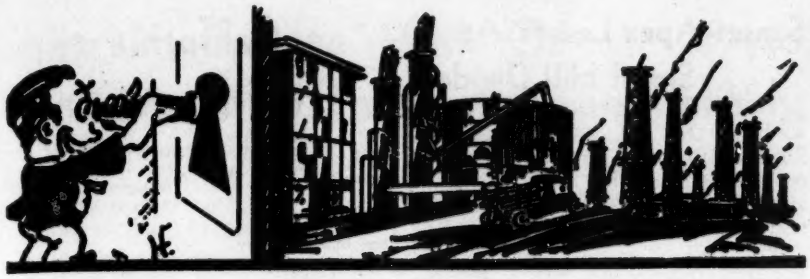
Reserve Oil & Gas Co. has made a location for its No. 33-3, on sec. 33, 11-19.

East Edison Oil Co. has made a location for its No. 2, on sec. 22, 30-30, Edison.

■ ■ ■

Maricopa Land Bought

Sunset Oil Co. recently acquired title to the Beverly property in Maricopa Flat, sec. 6, 11n-23w. The land, purchased in fee, totals 42.16 acres. At the present time it is producing about 2000 bbls. per month, but Sunset intends to step up production by drilling a couple of new wells.



The consensus of expert opinion would now indicate that knocking may be ascribed to one of three things—opportunity, jealousy, or carbon.

■ ■

And Gil Reeves declares that it's the fireman who invariably makes it hot for the engineer.

■ ■

Harry Lee, on the other hand, maintains that if one half of the oil men knew how the other half lived, they could make plenty of money selling magazine stories.

■ ■

Now comes Max Anfenger recommending the safety helmet as a means of removing superfluous hair.

■ ■

It has been rumored, also, that since refinery operators are forbidden to smoke in the plants, cigarette manufacturers are going to retaliate by asking their employees to stop using gasoline.

■ ■

And Hubert Ferry says it is a mistake to define the officials of the water disposal system as a drain board.

■ ■

In spite of the fact that he has hunted almost every species of big game on the American continent, Bill Waddell just learned the other day that you have to drill for wildcats.

■ ■

Wynn Lynch was interviewing an applicant for work, and asked him among other things, "Why are you out of work now?" "Well," replied the hopeful one, "There just ain't nothing doing in my line these days." "What is your line?", Wynn next inquired, and you could have knocked him over with a casing perforator, when the applicant answered, "I'm a window box weeder."

■ ■

Did we ever tell you, by the way, that in the new job classifications, the operators of these perforation guns are designated as the "gunemployed."

■ ■

At 6:30 tonight, there will be a joint meeting of the California Natural Gasoline Association and the Petroleum Accountants Society in the Mary Louise tea room at Barker Bros., to celebrate the return of prosperity. In view of the improved business outlook, Gordon Campbell will explain a new system of petroleum accounting, in which black ink is substituted for red.

■ ■

Chief Davis of the Los Angeles police force will be there to renew old acquaintances and give the boys a few sentences.

■ ■

By the way, there haven't been nearly so many jail breaks lately, and we just wonder in passing if the Chief is in any way responsible for fixing all the leaky pens.

■ ■

And with the almost universal adoption of canned lubricating oils, the young bride is no longer the only person who must become proficient in the use of the can opener.

■ ■

The success of this commodity, incidentally, is concrete evidence of the wisdom of making money while we can.

■ ■

To show the intense interest of oil workers in their business, Fred Owens now tells a conversation that took place between two production men. Says the first one, "Did you hear that Bill Binks died today while he was drilling on Dusty No. 1?" Says the second one, "My gosh! How deep was it?"

■ ■

And Roy Fry narrates the case of a foreman who found one of his men asleep on the job. There was nothing to do but make him sit up and take notice.

■ ■

"I suppose you heard that I was running for office?" said the aspiring pumper to Dick Hoover. "Yeah," says Dick, "I heard some of the boys laughing about it."

■ ■

It sounds kinda silly really, but we were told just the other day that a young lady's wash hanging out on the line on a windy day first suggested the idea of whipstocking.

■ ■

Whipstocking may be all right in its place, but it is our candid opinion that the entire drilling business is being run into the ground.

■ ■

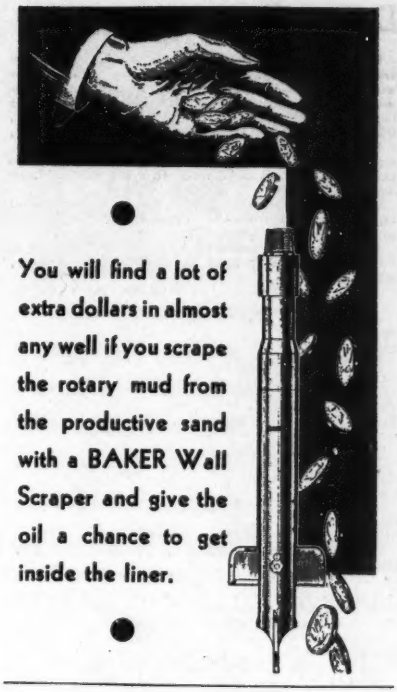
And we have just learned from Frank Coyle that a certain oil man has been ordered by his doctor to go to a warmer climate. It's a remarkable coincidence that we have several times asked this guy to do the same thing.

■ ■

Apropos of nothing at all now, how many of our readers can remember the good old days when it was necessary to loosen a girl's clothing if she fainted?

■ ■

With which we conclude. Remember you can get more for your money if you put the tooth paste tube through the wringer.—R. S.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Drilling Report

Oil field operations reported during the week ended November 21, show 31 notices to drill new wells filed, as compared with 18 during the previous week. 2 were in Wilmington, 1 each in Dominguez, Huntington Beach, Richfield, Torrance, Ojai, and Santa Maria, 2 in Santa Maria Valley, 1 in San Luis Obispo county, 18 in Kern county, and 2 in Kettleman North Dome. Total new wells this year, 967, as compared with 905 at the same date last year.

Deepening or redrilling jobs this week numbered 13, as compared with 19. Total to date, 722; total to same date last year, 727.

Abandonments numbered 9, as compared with 7. Total to date, 429; total to same date last year, 362.

	Well No.	S.	T.	R.
NEW WELLS				
Wilmington				
Selegna Oil Co.				
Menveg	1	28	4 S	13 W
Sunset Oil Co.				
Lupie	3	28	4 S	13 W
Torrance				
Frans Nelson Petroleum Co...	2	18	4 S	14 W
Dominguez				
Union Oil Co.				
Callender	48	33	3 S	13 W
Huntington Beach				
Car-Fad Oil Co.				
Doran	1	2	6 S	11 W
Richfield				
Standard Oil Co.				
Kraemer 2	24	32	3 S	9 W
Ojai				
St. Louis Oil Co.				
Pirie	3	12	4 N	23 W
San Luis Obispo County				
A. T. Jergins Trust				
Indian Knob	1	26	31 S	12 E
Santa Maria				
W. D. Shaffer, Trustee				
Houk	1	9	9 N	33 W
Santa Maria Valley				
Union Oil Co.				
Mahoney	2	24	10 N	34 W
Adam	2	24	10 N	34 W
Midway				
C. C. M. O. Co.	J-1	21	32 S	23 E
The Texas Co.	17	32	32 S	24 E
Standard Oil Co.	28	3	32 S	24 E
Union Oil Co.				
Keene	4	22	32 S	23 E
Williams	3	22	32 S	23 E
Sunset				
Oil Incorporated	2	7	11 N	23 W
Devil's Den				
Lube Oil Co.				
Gordon	1	2	25 S	18 E
Kern River				
Bishop Oil Co.	10	23	28 S	27 E
California Star Oil Co.	7-40	22	28 S	27 E
Associated Oil Co.				
Reed Crude	11	34	28 S	28 E
Alvah M. Kaime				
Seskayden-Sesnon	2-A	17	28 S	27 E
Poso Creek				
Roscoe and Stanley				
New Hope	1	29	27 S	27 E
Honolulu Oil Corp., Ltd. 88 &	59	8	28 S	27 E
Mt. Poso				
C. C. M. O. Co.				
Mon	3	26	27 S	28 E
Warren Deuel	2	28	27 S	27 E
Fruitvale				
California Star Oil Co.				
Moore	2	21	29 S	27 E
Mountain View				
Standard Oil Co.				
Calif. Lands Inc.	3	13	30 S	28 E
Kettleman North Dome				
Kenda	61	4	22 S	17 E
Kenda	36	28	21 S	17 E
DEEPEN OR REDRILL				
Santa Fe Springs				
The Texas Co.				
Weaver	5	6	3 S	11 W
Bardeen Petroleum Co., Ltd...	2	6	3 S	11 W
Orange County				
C. M. Isaacson & N. T. Zuver				
Yorba Linda-Day	1	21	3 S	9 W
Huntington Beach				
George Terry				
Crane	2	2	6 S	11 W
Union Oil Co.				
Copeland	16	35	5 S	11 W
Cordova Oil Co., Ltd.				
Wardlow	2	2	6 S	11 W
Long Beach				
The Texas Co.				
Foster 1	4	19	4 S	12 W
Consolidated Petroleum Co.				
Rogers	1	29	4 S	12 W
Inglewood				
Standard Oil Co.				
Vickers 1	30	7	2 S	14 W
Rosecrans				
Sunset Oil Co.				
Marine	31	7	3 S	13 W
Rincon				
Surf Oil Co.	4	8	3 N	24 W
Midway				
Murietta Development Co.				
El Camino	24	26	31 S	22 E
Elk Hills				
Standard Oil Co.	28	35	30 S	24 E
ABANDON				
Long Beach				
Milpet Corp.				
Campbell	8	30	4 S	12 W
Santa Fe Springs				
John P. Flaming & John Surber				
S. F. Springs	1	5	3 S	11 W
Lawndale				
L. Jean Marvin				
Woods	1	7	3 S	14 W
Playa del Rey				
Owens & Montgomery	1	27	2 S	15 W
Arroyo Grande				
A. T. Jergins Trust				
Rodrigues	1	5	32 S	13 E
Midway				
Safeway Oil Co.	1	26	32 S	23 E
Lost Hills				
Associated Oil Co.				
Taylor	1	1	26 S	20 E
Trico Oil and Gas Co.				
California-Western	1	7	23 S	23 E
Round Mountain				
Round Mountain Oil Co.				
Jewett	2	19	28 S	29 E

Sunset-Apex Leases At Signal Hill Divided

DIVISION OF several leases at Signal Hill, until now jointly owned and operated by Sunset Oil Co. and Apex Petroleum Co., was announced early this week.

The leases involved include the Freedman-Ball, the Morris, the Whitney, and the Cal-Mex leases. Sunset Oil Co. will now own the Whitney lease and the north half of the Cal-Mex lease, while Apex Petroleum takes the Freedman-Ball, the Morris, and the south half of the Cal-Mex property.

The division of wells on the Cal-Mex lease is as follows: Sunset takes Marine 21, 22 and 24, and Apex gets Marine 20, 25, and 26. On the Whitney lease, Sunset will take over Marine 16, 16A, 17, 17A and 18. Apex Petroleum Co. will own Marine 13A, 13B, 14 and 15 on the Morris lease, and Marine 11 and 12 on the Freedman-Ball property.

All facilities have been divided and the two companies will operate their holdings as separate properties in the future.

■ ■ ■

Nine Springs Starts Well

Nine Springs Oil Co., sec. 10, 7n-30w, Laguna Ranch, south of Santa Maria, is starting its first well. The location is on the Solomon Hills anticline some six miles southeast of Barnsdall's Gato Ridge discovery well.

J. E. Pettijohn of San Diego is president of Nine Springs, whose backers are mostly the group who drilled a wildcat below 6000 ft. in San Diego county. George Doan, formerly with Milham, now Seaboard, is the geologist.

• California • Production

AVERAGE PRODUCTION
November 21 to 27, 1936, inclusive

	November Quota	Barrels Production
San Joaquin Valley		
Belridge—North	10,560	13,506
Belridge—South	1,975	1,896
Buena Vista	16,770	16,463
Coalinga—East	11,725	10,499
Coalinga—West	5,350	5,674
Coffee Canyon	4,700	4,833
Edison	5,320	5,507
Elk Hills	8,160	8,235
Fruitvale	7,795	9,376
Kern Front	9,780	10,030
Kern River	3,380	2,370
Kettleman Middle Dome	375	253
Kettleman North Dome	77,150	76,561
Lake View	3,015	535
Lost Hills	4,255	3,369
McKittrick	3,680	1,693
Midway-Maricopa	32,395	39,174
Mount Poso	15,555	17,619
Mountain View	21,870	20,904
Poso Creek	1,715	1,939
Round Mountain	6,860	3,995
Ten Section	695	1,033
Wheeler Ridge	340	420
Others	.....	.....
TOTAL	253,420	255,884
Coastal District		
Capitan	1,705	1,786
Elwood	10,810	11,455
Padre Canyon	345	535
Rincon	1,860	2,235
San Miguelito	1,155	1,806
Santa Barbara	1,090	984
Santa Maria	4,850	4,916
Santa Paula-Newhall	4,250	4,789
Ventura Avenue	29,205	35,191
Others	310	195
TOTAL	55,580	63,892
Los Angeles Basin		
Alamitos Heights	1,510	1,705
Brea-Olinda	7,950	7,601
Coyote—East	2,280	2,526
Coyote—West	7,855	7,379
Dominguez	22,380	24,931
El Segundo	310	357
Huntington Beach—New	18,560	20,636
Huntington Beach—Old	13,465	14,015
Inglewood	12,255	13,198
Lawndale	80	81
Long Beach	60,030	64,859
Los Angeles	645	710
Montebello	5,925	5,521
Montebello Extension	2,095	3,349
Playa Del Rey	11,495	11,180
Potrero	290	272
Richfield	6,800	5,967
Rosecrans-Athens	1,965	2,132
Santa Fe Springs	41,135	44,083
Seal Beach	7,355	6,366
Torrance-Hermosa	5,565	6,278
Torranco Extension	1,835	1,813
Whittier	995	928
Others	530	394
TOTAL	233,305	246,281
STATE TOTAL	544,000	566,057

■ ■ ■

Carpinteria Well Starts

Julius Dietzman and associates, who are drilling one well at Newhall, are starting another at Carpinteria.

Strike Interference With Oil Tankers Or Trucks Appears Unlikely

PRESENT INDICATIONS are that operation of oil tankers will not be interfered with by the shipping strike. As these lines are written, negotiations are being reopened between the strikers and the employers, which, if successful, will remove all possibility of any trouble for the oil industry. Regardless, however, of whether the strike is ended quickly or continues, the California Oil World is able to say upon what should be good authority that in all probability there will be no move against the oil industry on sea, although it is impossible to say with absolute certainty what the marine union leaders in San Francisco may possibly do.

Open Shop on Tankers

Tankers are operating on the open shop plan. Crews include both union and non-union men. Longshoremen are not employed to load oil, which is done through pipe lines handled by oil company employees who are either non-union or members of the Oil Workers Association, and that organization is distinctly not striking. It has made satisfactory verbal agreements with a number of leading companies which have given increased wages and better working conditions to the men, and neither the rank and file or the leaders want to endanger what they have gained.

At the beginning of the strike, an informal agreement was made to load only through pipe lines, and to abandon temporarily the shipment of oil in drums or cases which must be loaded by longshoremen. Only one foreign tanker has taken on case goods during the strike.

While there is a strong fight on by the Teamsters' Union to halt all inland trucks, it has not affected the movement of oil or gas up to this writing (Tuesday morning).

As a part of its program to enroll all men employed in the oil industry in any capacity, the Oil Workers Association has been approaching truck drivers employed by the oil companies and soliciting their membership. It is denied, however, that this course is dictated by any intention to stir up trouble of any kind and that nothing in the way of a strike is contemplated.

Representatives of the Teamsters Union (truck drivers) are reported also to be seeking the support of oil company drivers but the latter are said to be cold and unresponsive. The oil companies are paying as much as, and sometimes more than, the Teamsters' wage scale, hence a deaf ear is generally turned to appeals by the Teamsters.

The Oil Workers Association is an industrial union. As such it has just been thrown out of the American Federation of Labor. The first result of this expulsion from the Federation is that the money heretofore paid in dues to the Federation will now be saved and be available to finance the Oil Workers business, hence none of its leaders or members show any signs of being disturbed by what has happened. In fact, they seem to think that they are, from their point of view, in very good company as the expulsion applies also to the Coal Miners, Steel Workers, and a number of other leading organizations, even the International Typographical Union having joined the exodus.

Ultimate Outcome

As to what may be the ultimate result of the breakdown of the American Federation of Labor insofar as oil labor is concerned, only guesses are yet possible. While claiming the right to enroll all oil company employees under its own banner, the Oil Workers Association has so far raised no objections to the various craft unions, such as the Boilermakers, Electricians and others, who have members in oil employ, carrying any negotiations they can with the companies. Whether this attitude will be permanent now that the break with A. F. of L. has come to a head may be an interesting subject for speculation, but that is all. Meanwhile, the open shop principle prevails practically throughout the oil industry in California.

At this moment the practical question is whether there is danger of strike conditions as they spread inland affecting the oil truck deliveries. So far the answer appears to be no.

■ ■ ■

Associated Grades Site

Associated has graded a site for its Avenal No. 2, Kreyenhagen Hills, Kings county, sec. 35, 23-17.

AGENCY	Established
LONG BEACH	1929
TAFT	1931
OKLAHOMA CITY	1931
BAKERSFIELD	1933
HOUSTON	1933
KILGORE	1933
WICHITA	1934
LYONS	1934
PAMPA	1935
ODESSA	1935
LAKE CHARLES	1936
VENTURA	1936

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Pampa, Texas
Oklahoma City, Oklahoma
Wichita, Kansas
Lyons, Kansas
Lake Charles, Louisiana

California October Crude Runs 15,728,433 Bbls.; 507,369 Daily

OCTOBER RUNS of crude to stills of 56 active California refineries totaled 15,728,433 bbls., daily average 507,369, (U. S. B. M. report), equal to 87.6% of the state's October production. The runs show a decrease of 18,000 bbls. daily. They include a total of 554,556 bbls. of non-gasoline-bearing crude used for the manufacture of lubricants, asphalt, road oil, etc.

Refineries also ran 86,868 bbls. and used for blending 1,058,233 bbls. of natural gasoline, a total utilization of 1,145,101 bbls., eqqual to 87.3% of the state's total October production.

Of the state's October production of crude 1,709,747 bbls. were transferred to stocks of non-gasoline-bearing crude and fuel residuum. These transfers amount to 9.5% of the state's production. The transfers do not vary much month by month and furnish the only statistics as to the state's yield of light and heavy crude.

October shipments of crude came to a total of 1,050,359 bbls., all to Pacific foreign ports, including the Panama Canal zone. October shipments (daily average, 33,882 bbls.) were 4000 bbls. per day less than September's. October shipments of natural gasoline totaled 113,293 bbls., all to Pacific foreign ports. The daily average was 3655 bbls., an increase of 1000 over September's daily average.

September marked the end of the peak demand for gasoline, and October output was cut to fit the lower consumption. October's manufacture of California gasoline totaled 6,525,702 bbls., daily average 210,507; September's was 6,686,981, daily average 222,899. October shipments of gasoline amounted to 1,176,149 bbls., daily average 37,940; September's to 1,818,667 bbls., daily average 60,611. October domestic demand came to 5,091,614 bbls., daily average 164,245; September's to 5,344,909 bbls., daily average 178,163, the decline in October domestic demand being 13,918 bbls. per day. Total October demand, domestic and shipments, came to 5,983,602 bbls., daily average 193,019; September's to 7,163,576 bbls., daily average 238,786. The total decline in market demand, domestic and foreign, during October as compared with September was 45,761 bbls.

October's decline in shipments may have been due in part to the heavy shipments made during September in anticipation of possible trouble during the marine strike which may have filled the tanks at some points.

October witnessed the arrival on the Pacific Coast of 72,938 bbls. of gasoline from Texas in the face of lessened demand. Stocks of gasoline were increased during October by 440,057 bbls., and amounted to 13,237,572 bbls. on Oct. 31.

Lubricants were imported from the Eastern, Mid-Continent and Rocky Mountain states into Pacific Coast territory during October to a total of 68,042 bbls. Offsetting these receipts were outgoing shipments of lubricants to a total of 78,962 bbls.

Total Stocks on Hand

The following table shows the total of all products on hand Oct. 31 and Sept. 30:

	Barrels	
	Oct. 31	Sept. 30
Gasoline-Bearing Crude	33,900,819	34,123,055
Natural Gasoline	1,954,771	2,067,148
Finished Gasoline	13,237,572	12,797,515
Kerosene	1,232,931	1,147,430
Lubricants	1,012,850	1,032,842
Gas-Diesel Oil	8,588,725	9,010,602
Non-Gasoline-Bearing Crude, Residuum	64,745,472	64,564,208
Asphalt-Road Oil	509,349	469,877
Coke, etc.	329,468	341,587
Naphtha Distillates	2,193,913	1,820,724
Other Unfinished Oil	5,174,315	5,379,988
TOTALS	132,880,185	132,754,976

The estimated gasoline recovery from naphtha distillates on hand Oct. 31 was 1,763,723 bbls.

■ ■ ■

Joint Meeting Scheduled

A joint meeting of California Natural Gasoline Association and the Petroleum Accountants Society is being held in the Mary Louise Tea Room at Barker Brothers, tonight, Dec. 3.

The main address will be a paper on "Natural Gas and Gasoline Accounting," by Gordon Campbell, oil accountant, General Petroleum Corp.

As an added feature, Chief Davis of the Los Angeles Police Force will deliver a talk on "Communism," and R. D. Gibbs has promised definitely that the long lost movie, "Finny Fighters of the Deep," will be shown.

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Geologists' Association To Meet In Los Angeles For '37 Convention

CALIFORNIA WILL be host to the American Association of Petroleum Geologists, meeting in national convention at Los Angeles, Mar. 17, 18 and 19, 1937. The last time this national organization came to California was nine years ago, in 1928, when its annual convention was held in San Francisco. Since then national conventions have been held in San Antonio, Dallas, Fort Worth, Wichita, Tulsa, New Orleans, and elsewhere, for the Association follows the rule of meeting each year in a different city, thus not allowing itself to become localized. Next year's meeting in Los Angeles comes hand in hand with, and largely as the result of, the election of Ralph D. Reed of Los Angeles, chief California geologist of The Texas Co., as president.

Quite recently, Los Angeles was host to the Pacific Section of the Geologists Association as it has been a number of times before. These annual meetings are essentially for business discussions. The papers read contain a mass of information which has, and always will have, the utmost value.

Membership in the national organization totals some 2300 in all parts of the United States, of which number about 275 are in California. Attendance at the 1936 convention at Tulsa numbered 1890. Because of the distance from the big fields outside of California, next year's attendance may be somewhat less but fully 1000 persons are expected to come in consequence of the meeting. Some of the world's greatest geologists always attend these annual conventions.

California petroleum geologists are already preparing for the coming convention by the appointment of chairmen of committees to have charge of the various phases of business and entertainment. Frank A. Morgan, Rio Grande Oil Co., has been named General Chairman. He has selected the following members for the General Committee:

C. R. McCollom, G. C. Gester, Vernon L. King, R. W. Sherman, R. S. McFarland, W. B. Heroy, Frank Clark.

Other chairmen are: H. W. Hoots, Union Oil Co., technical sessions; A. A. Curtice, consulting engineer, finance; Richard G. Reese, Standard Oil Co., entertainment; Roy M. Barnes, Continental Oil Co., publicity and exhibits; Earl B. Noble, Union Oil Co., hotels; J. E. Elliott, Elliott Core Drilling Co., registration; W. S. W. Kew, Standard Oil Co., field trips; H. J. Steiny, Associated Oil Co., transportation; Angus McLeod, Shell Oil Co., golf; E. F. Davis, Shell Oil Co., reception.

Union Executives Meet

On Jan. 4 the International Executive Council of the Oil Workers Association is scheduled to meet in Long Beach. There are 10 members: President Harvey Fremming, Vice-President John L. Coulter, and Secretary James C. Coulter, the last named a resident of Long Beach, all ex-officio, and one delegate from each of seven districts recognized by the Association, — California, Wyoming-Montana, South Texas, North Texas, Louisiana, Oklahoma and Pennsylvania.

On Jan. 2 the State Council of Oil Workers will meet in Long Beach.

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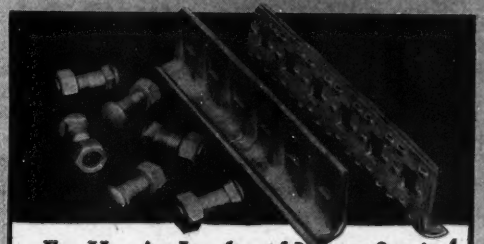

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New Iniative Measure Offered To Solve Tideland Oil Problems

INITIATIVE PETITIONS are being circulated for signatures on the streets of Los Angeles and other California cities addressed to the Legislature, which meets right after Jan. 1, asking for the enactment of a measure which (1) prohibits beach oil drilling; (2) prohibits surface oil drilling on tide, overflowed and submerged lands; (3) creates a State Mineral Commission to consist of three members: the State Director of Finance, the State Controller, and the State Supervisor of Oil & Gas; (4) prescribes the Commission's authority, including the power of eminent domain; (5) directs the Commission to grant an operating contract to Independent Producers, Inc., to drill for oil beneath tide, overflowed and submerged lands by slant drilling from uplands; (6) provides that the state shall receive 40% of the net proceeds of the development; (7) makes an appropriation to carry out the provisions of the proposed law; (8) repeals all conflicting legislation.

Independent Producers, Inc., is a new company. Only three names have yet appeared in connection with it: A. E. Wright, oil lands agent; J. Barton Hutchins, Barnsdall's former land agent, who resigned some months ago to engage in business for himself; and J. L. Hutchins. They decline to make public the backers of the enterprise at this time but say they will do so later. Despite some similarity in the names, this company has no connection with, and is not backed by the same people as, the Independent Oil Companies Consolidated, which drew up but did not submit to the voters an initiative measure which would have given it a monopoly of all tideland operations.

Necessary Procedure

It will be necessary for the sponsors of the proposed law to obtain, in round numbers, 116,000 signatures of legal voters, equal to 5% of the vote cast at the last election, before Dec. 5. When the petition is received the Legislature may enact the proposed law. If it does this there will be no popular vote required. Should the Legislature decline to pass the measure it will be voted upon by the electors at the next election.

First appearance of the measure for circulation at Sacramento has been greeted by a blast from the Governor who declares that 60% is not enough for the state which, in his opinion, is entitled to all the returns after drilling expenses have been paid. He declares that, if contracts for development under these conditions can not be made, the state should drill the lands itself. However, owing to the fact that if the Legislature enacts the proposed law it will so act in response to a properly signed initiative petition, the governor will have no veto power.

Disposal of Revenue

The State Mineral Commission will collect all the money due the State under the 40% royalty provision of the proposed law, which shall be deposited to the Commission's credit in the State Treasury. Out of such funds the Commission will pay all its expenses, including salaries of all employees, the amount of which will be fixed by the Commission. At the end of each fiscal year all money remaining in the fund shall be distributed: one half to the General Fund of the State, the other half to the Department of Natural Resources. Of the money paid to the Department of Natural Resources one half shall be used to acquire, improve and maintain the public ocean beaches; the other half shall be used to operate and increase the facilities of the State Park System.

Mineral Commission's Powers

Powers of eminent domain are granted the State Mineral Commission for the purpose of acquiring, by condemnation, drill sites, surface and subsurface rights of way, and land needed for tank farms and other requirements incidental to oil development. The Commission will be "authorized and directed to execute, for a term of 20 years from and after the date on which this Act takes effect, and as long thereafter as oil and gas is produced in paying quantities, an operating contract to Independent Producers, Inc., a corporation, its assignees and successors in interest "to develop oil, gas and other hydrocarbons from "tide, submerged or overflowed lands" by slant drilling.

Cities May Not Halt Slant Drill

It is expressly provided that this right of development shall be "irrespective of any acreage limitations"; that such development shall be allowed under the supervision of the Commission whether the lands involved front on any incorporated city or not; and that "neither the state nor any political subdivision thereof, nor any city, nor city and county, shall by law or ordinance in force or hereafter passed, hinder, delay or limit the right of the Independent Producers, Inc., to operate as herein provided in this Act".

Tidelands, Beach, Uplands Defined

The proposed law defines "tidelands" to mean "lands owned by the state below the line of ordinary high water mark, also lands adjoining said lands but raised above the same by causes other than natural accretions and whether filled or unfilled". Furthermore, "tide, overflowed and submerged lands include all lands heretofore granted by the state to a city or county wherein the state retained or reserved the mineral rights" under such lands.

The word "uplands" is defined to mean "lands above tidelands and above beach lands whether adjoining the same or not".

"Beach lands" are defined as meaning "those lands above the line of ordinary high tide to the edge of a bluff, and if no bluff, then not to exceed 200 ft. above the line of ordinary high water mark".

Company Pays Taxes

Out of its receipts from the disposal of oil, before the funds are divided with the state, the Independent Producers, Inc., must pay all operating expenses, all taxes (excluding income taxes), licenses or other governmental charges, as well as the cost of any litigation incurred, and must reimburse the Mineral Commission for all expenses of condemning and acquiring drill sites and other lands. The remaining funds will be divided between the company and the state on a 60-40 basis.

Only Geologic Structures

The proposed law distinctly provides that there may be no drilling under its authority unless and until the "location shall be within the boundaries of a known geological structure of a producing gas or oil field". Under this provision, wildcat drilling in the hope of locating a new submarine structure will be barred. Such provision should set at rest the fears of persons who think the entire coast line from Oregon to Mexico will be placed in danger of being lined with derricks.

Bureau Of Mines Forecast For Oil Requirements Increased For December

THE DAILY AVERAGE production of crude oil for December, 1936, recommended by the Bureau of Mines to meet the estimated demand is 2,930,300 bbls., 60,000 bbls. more than the recommendation for November, to provide for anticipated winter heating and fuel oil needs.

During the last five weeks (ended Nov. 7) for which complete data are available, the daily average production of crude was about 3,067,000 bbls., or about 35,000 bbls. greater than the production in September. The average withdrawal from domestic crude stocks over this period was about 119,000 bbls. daily, indicating a daily demand of 3,186,000 bbls.

Present market trends indicate a continuance of the increased demand for petroleum products during the first quarter of 1937 with probable increases in the amount of new crude required, particularly from those states which supply refinery districts serving areas of large fuel oil consumption.

Insufficient data, unpredictable weather conditions and divergence of opinion as to the probable trend of refinery operations do not warrant a detailed forecast for more than one month in advance. However, a review of consumption trends indicates a probable increase of about 9% in the total demand for motor fuel and an average monthly increase of about 4,000,000 bbls. in the total demand for heating and fuel oils for the first quarter of 1937 as compared with the same period in 1936.

Motor Fuel

Domestic demand.—The domestic demand for motor fuel in December is estimated as 36,400,000 bbls., or 8% higher than the actual demand of December, 1935.

Exports.—Exports have been estimated as 2,300,000 bbls., 100,000 less than for November, and 900,000 less than for December, 1935.

Stocks.—Stocks of finished and unfinished gasoline on Sept. 30 amounted to 57,800,000 bbls., a decline of 1,696,000 for the month, compared with a recommended withdrawal of 3,980,000 bbls. According to A.P.I. statistics, stocks were further reduced during October by 237,000 bbls., which would bring this figure to approximately 57,560,000 bbls. as of Oct. 31, compared with 49,798,000 on the same date last year. Although these stocks are generally considered higher than is healthful for the industry even with the increase in demand, it is evident that they will be increased considerably during the winter months incidental to the running of crude to produce enough fuel oil to meet the estimated demand based on present market trends.

Gasoline production.—Benzol and direct sales and losses of natural gasoline have been estimated as 750,000 bbls., making the estimated production of gasoline 41,450,000 bbls., which is distributed among the districts as follows (thousands of barrels): East Coast, 6610; Appalachian, 1550; Indiana-Illinois, 6700; Oklahoma, 3060; Kansas-Missouri, 2560; Texas Inland, 3230; Texas Gulf, 8640; Louisiana Gulf, 1570; Arkansas-Louisiana Inland, 880; Rocky Mountain, 970; **California, 5610.**

Fuel Oil

The domestic demand for gas oil, distillate fuel oil and residual fuel oil for the first nine months of 1936 of 294,500,000 bbls. was 32,333,000 bbls. or 12.3% higher than for the same period of 1935. Although part of this is attributable to the extremely cold weather during the first two months of this year, the higher consumption during the other months of the year and the increasing number of oil burner installations indicate that the trend is definitely upward.

Total demand for the third quarter of 1936 was almost 11,000,000 bbls. greater than in the same period in 1935, or an average monthly increase of 3,666,000 bbls. The growth in the market for residual fuel oil was responsible primarily for this increase. While normally such oil is considered as a by-product incident to the production of the more desirable gasoline and distillate oils, the projection of present market trends indicates that refiners will meet this demand during the coming quarter.

To meet this upward trend and possible excess requirements because of severe weather, there were 18,860,000 bbls. of gas oil and distillate fuel oil in storage east of California on Sept. 30, or 1,515,000 bbls. more than on the same date in 1935, and 20,182,000 bbls. of residual fuel oil, or 7,169,000 less than on the same date in 1935. This situation indicates that the fuel oil requirements for the coming months will require unusually heavy runs to stills with consequent large additions to gasoline stocks. Provision has, therefore, been made for additions of 3,500,000 bbls. of gasoline to stocks during the month of December.

Crude

Runs to stills.—Natural gasoline to be used is estimated as 8.3% of the total gasoline made, or 0.7% lower than November's estimate. This is in accordance with the usual seasonal change. The estimated yield of straight-run and cracked gasoline has been reduced from the 44.14% estimated in November to 43.62% to anticipate a greater yield of fuel oil. The application of this yield to the estimated gasoline production of 38,010,000 bbls. gives 87,140,000 bbls. as the crude required at refineries.

Imports.—Runs of foreign crude have been estimated as 2,800,000 bbls.

Exports, fuel, and losses.—Exports of crude have been estimated as 3,900,000 bbls., a decrease of 100,000 from the November estimate, while the "fuel and losses" estimate has been increased 100,000 to 2,600,000 bbls.

Required production.—The application of the usual methods to the total required production of crude oil gives the following recommended break-down by states:

TABLE I.—RECOMMENDED LEVELS OF CRUDE OIL PRODUCTION BY STATES[1]
(Daily averages in barrels)

State	Dec., 1936	Dec., 1935
Texas	1,145,200	1,005,800
Oklahoma	567,000	480,100
California	553,400	513,800
Louisiana	204,800	128,000
Kansas	155,900	138,700
New Mexico	78,300	55,500
Pennsylvania	48,800	39,700
Wyoming	40,200	35,100
Michigan	29,300	41,800
Arkansas	26,800	28,100
Kentucky	14,500	14,300
Montana	14,300	11,500
New York	11,900	10,300
Illinois	11,900	10,900
Ohio	11,200	10,500
West Virginia	10,100	10,000
Colorado	4,500	4,000
Indiana	2,200	2,100
	2,930,300	2,540,200

[1]The recommendations in this table have been calculated as the requirements for the months stated.

■ ■ ■

Workers Give Tree

On Dec. 21 the Oil Workers Association of Long Beach will give its annual tree for the children at the Belmont Shore Club. Following the distribution of gifts by Santa Clause, there will be dancing.

Estimation of Oil and Gas Reserves

By R. L. Huntington

FOR a number of years the sand volume-saturation method has been used as a means of estimating the quantities of crude oil and gas present in underground reservoirs. This method has given satisfactory results only in fields where the geological data are sufficiently complete to define the limits of the pool. In 1929, Coleman, Wilde and Moore developed a method that makes it possible to determine the contents of a reservoir based on a material balance; that is, the contents of the original reservoir are equal to the fluid produced up to any time plus the quantity remaining in the reservoir at that time. To carry out such calculations, pressure-volume-temperature relationships and solubility-shrinkage data on the reservoir fluids had to be obtained along with statistics on the accumulated production of the crude oil and gas over the various periods. Ben E. Lindsly contributed much toward this phase of the work through the analysis of bottom-hole fluids from several major oil fields. Schilthius has recently estimated the initial fluid content of the Conroe field in a quantitative manner through the study of such factors as water encroachment, the presence of a gas cap and "active" oil. Katz has made calculations on the Wilcox sand of the Oklahoma City field and has obtained consistent results based on oil and gas production data covering a four-year period. This new method of estimating the size of crude oil-gas reservoirs is particularly adapted to fields in which the limits of the producing zone have not been defined by the drill. In well defined fields where confidence has been placed in the sand volume-saturation method, the material balance as originated by Coleman and his co-workers may also well serve as a check on the former plan of making calculations. The purpose of this paper is to show how further applications may be made in the use of the material balance as well as the necessary precautions to be taken and the limitations of the accuracy of such calculations.

The Estimation of Gas Reserves

This new principle can be applied to the calculation of gas reserves. In applying the material balance, it may be stated that the amount of gas originally present in a gas reservoir is equal to the amount produced up to any date plus the amount remaining in the reservoir on that date. In the absence of sand volume-porosity data for a reservoir in which no oil is present, the method of determining the original amount of gas may be illustrated by the following hypothetical case:

Referring to Lindsly's data, it is found that for an average Mid-Continent crude oil about 23 cu. ft. of gas go into solution per barrel of residual crude oil for every 100 lbs. increase in pressure throughout the range of 500 to 2000 lbs. per sq. in. The 23 cu. ft. of dissolved gas occupy a space of 0.0535 cu. ft. in the crude oil. It is assumed that 750 mil. barrels of liquid are in the reservoir, of which 625 million barrels are residual crude oil. Assume further that equilibrium exists between the oil and gas at all times.

	Pressure	Temp.	Compressibility factor of gas	$=\frac{PV}{RT}$
Orig. reservoir conditions	2,000	125°F.	0.85	
Av. reservoir conditions at time ϕ	1,200	123°F.	0.88	

Cubic feet of gas produced up to time ϕ = 50 billion cu. ft. measured at standard conditions. Assume further that during the production of the gas one-tenth of the original reservoir was flooded through water encroachment. Let V equal the number of cubic feet of original pore space filled with gas at initial reservoir conditions and of a composition comparable to 90 per cent methane and 10 per cent propane. The compressibility factors were taken from original data published by Sage, Lacey and Schaafsma.

Solution

Standard cu. ft. of gas at 14.7 lbs. per sq. in. abs. and 60°F. Original gas reserve = produced gas + gas remaining in reservoir.

$$V \times \frac{2000}{14.7} \times \frac{250}{585} \times \frac{1}{0.85} = 50{,}000{,}000{,}000 + 0.9\,V \times \frac{1200}{14.7} \times \frac{520}{583} \times \frac{1}{0.88}$$

$142.3V = 105{,}000{,}000{,}000$, original gas in reservoir
$105 - 50 = 55{,}000{,}000{,}000$, gas remaining in reservoir

In this particular problem it happens that the corrections for temperature and compressibility tend to offset each other.

Increase of Pressure

Assume that a reservoir that has been producing both oil and gas is now under a pressure of 1000 lbs. per sq. in., and that its crude oil, which occupies 75 per cent of the pore space, is in equilibrium with the gas cap, which fills the remaining 25 per cent of the voids. If the field were shut in, and edge water permitted to encroach sufficiently to fill 10 per cent of the original pore space occupied by the crude oil and gas, what pressure would be developed in the reservoir?

Solutions

Since a part of the gas goes into solution as the crude oil is forced into the gas-cap space, the increase in pressure is not directly proportional to the volume of the intruded water. Let V equal the volume in millions of barrels of the original pore space occupied by the oil and gas, or one billion barrels = 5.62 billion cu. ft. The volume of the gas cap before water-flooding would, therefore, be equal to 1.405 billion cu. ft. Let Z equal the number of 100-lb. increments in pressure due to water-flooding. The net shrinkage of the gas-cap would be equal to the volume of the gas-cap gas that goes into solution under reservoir conditions, less the increase in the volume of liquid due to the solution of the gas into the crude oil. In order to estimate the volume of gas-cap gas going into solution, it is necessary to resort to successive approximation.

Trial 1

Assume the final pressure on the reservoir to be 1250 lbs. per sq. in. abs. The net shrinkage of the gas cap in cubic foot due to the solution

of the gas into the crude oil will, therefore, be:

$$\frac{14.7}{\left(23 \times \frac{1000 + 1250}{2} - 0.0535\right)} \quad 625 \times 10^6 X$$

(neglecting any change in the compressibility factors of the gas in the pressure range, 1000 to 1250 lb. per sq. in.) $= 154 \times 10^6 Z$

The final pressure on the reservoir can be expressed in two ways. On the left-hand side of equation 1 (below), it is seen that the final pressure equals the initial pressure plus the number of 100-lb. increments of pressure. On the right-hand side, the final pressure is equal to the pressure that would have been exerted had the gas been compressed from 25 volumes to 15 volumes; i.e., 10 per cent of the total voids corrected for the factor

$$\frac{1405 - 154Z}{1405}$$

the fractional size of the new gas cap compared to that of the original, due to the effect of solution alone.

$$1000 + 100Z = 1000 \times \frac{25}{15} \times \frac{1405 - 154Z}{1405} \qquad (1)$$

$$Z = 2.34$$

P_2 (the final pressure $1000 + 100\ (2.34) = 1234$ lb. per sq. in.

The second approximation would give a pressure between 1234 and 1250, probably nearer the former pressure.

Trial 2:

$$\text{Gas-cap shrinkage} = \left(23 \times \frac{14.7}{\frac{1000+1234}{2}} - 0.0535\right) 625 \times 10^6 Z = 158.5Z$$

$$1000 + 100Z = 1000 \times \frac{25}{15} \times \frac{1405 - 158.5Z}{1405}$$

$$Z = 2.35 \qquad P_2 = 1000 + 2.35\ (100) = 1235$$

Therefore, the final pressure would equal 1235 lb. per sq. in. provided equilibrium was maintained between the encroaching oil and gas that was being compressed in the gas cap. In an actual case the rate of diffusion of the gas into the oil would be so slow that it is unlikely that any appreciable rate of water encroachment would keep the oil in a saturated state with respect to the gas in the gas cap.

Effect of Water Encroachment

If no edge-water drive takes place, it is reasonable to assume that the oil-gas pore space will remain substantially constant, throughout the life of the field. Whenever a series of calculations, over a long period, are made on a reservoir, and the results show approximately the same initial fluid content regardless of the year the data are obtained, the indications point toward the absence of water encroachment. However, in the event that the undrilled portion of a reservoir is connected to the developed sections through a narrow neck or a cross section of sand of low permeability, the calculations will be in error since the average bottom hole pressure in the proven area will not represent the average pressure over the field as a whole. If water were flooding the proven area of such a field, calculations would not reflect this encroachment since the increase in pressure, due to the approach of water would be offset by the lag in the equalization of gas pressure from the undeveloped portion of the reservoir. Should water encroachment not be taken into consideration in a field where there is an equal distribution of gas pressure, the calculated initial contents would, of course, increase with time. Vice versa it would be expected that the initial fluid content would fall off if corrections were made for water displacement. These corrections will have marked effect on the size of the estimated reservoirs, if they are made in the early life of the field when the bottom hole pressures are relatively high. Fig. 1 shows the great divergence in the effect of such corrections for water encroachment based on a reservoir that was assumed to have one billion barrels of initial fluid.

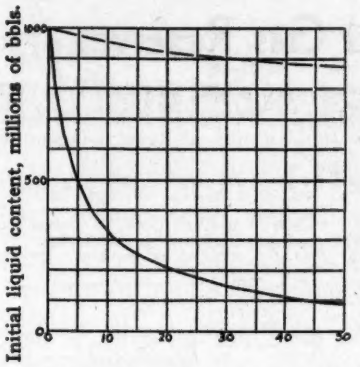

Fig. 1. Effect of water encroachment on estimated liquid content of reservoir, in which no original gas cap is present and crude oil is saturated with gas.

Lower curve: early date, 2000-lb. average bottom-hole pressure.

Upper Curve: late date, 400-lb. average bottom-hole pressure. At discovery, average bottom-hole pressure was 2600 lbs.

An example will best illustrate the steps taken in securing the calculated results given in Fig. 1. An average value was taken of several solubility shrinkage curves for Mid-Continent crude oils as determined experimentally by Lindsly.

Assume that 5 per cent of the reservoir has been flooded when the bottom-hole pressure has fallen to 400 lb. per sq. in. At that time, 272 million barrels of reservoir liquid fluid and 371 billion cu. ft. of gas measured at standard conditions have been produced.

Let V = Total Volume of original reservoir or space in millions of barrels.

Then 0.05V equals Volume of water (encroached) minus water produced.

Net amount of liquid removed from the reservoir equals: (272 0.05V) million barrels.

Let G equal Volume of Gas Gap in million barrels.

(Continued on Page 26)

(1) Using Katz'[2] method

$$G = 1 + \left(\frac{1}{0.0413 \times 437}\right) \qquad (272 - 0.05V = 1.058\ (272 - 0.05V) \text{ million bbl. or } (288 - 0.0528V) \text{ million bbl.}$$

Where 0.0413 equals the volume in cubic feet (gas-cap conditions) based on one standard cubic foot of gas, and 437 is equal to the number of standard cubic feet of gas evolved from 1 cu. ft. of liquefied or dissolved gas:

(2) Volume of residual crude to produce excess gas = 550 million barrels.

(3) Volume of residual crude to produce gas-cap gas
$(5.62 \times 437)\ (0.058)\ (272 - 0.05V) = (73.5 - 0.0092V)$ million barrels.
Where $(5.62 \times 437) = 2450$ cu. ft. gas evolved by one barrel of liquefied gas and 527 = number of cubic feet of gas evolved per barrel of residual crude oil between 2640 and 400 lb. per sq. in.

(4) Volume of oil-gas reservoir = volume of gas cap plus volume of remaining partially saturated crude oil.

Volume of reservoir = Volume of gas cap + vol. of remaining crude oil $(288 - 0.0528V) + 1.14\ (550\ [73.5 - 0.0092V])$ where 1.14 is the volume of the crude oil saturated at 400 lb. compared with the volume of residual crude at atmospheric pressure.
V = 983 million bbls. initial fluid present in reservoir.

Estimation Of Oil And Gas Reserves

Continued from Page 25)

This quantity is only 1.7 per cent less than the amount of fluid based on no water encroachment, whereas a 5 per cent water intrusion early in the life of the field would reduce the estimated initial fluid to 50 per cent of that in the constant volume reservoir.

Presence of a Gas Cap

In most oil-gas reservoirs where the crude oil is found in a saturated state, some free gas is usually present as a gas cap. A hypothetical reservoir having a crude oil similar to the one described in this paper has the following production record:

Residual crude oil produced = 27.3 million barrels.

Gas produced = 60.0 billion std. cu. ft.

Bottom-hole pressure = 1990 lb. per sq. in.

Original bottom-hole press. = 2460 lb. per sq. in.

Using the method employed by Katz[2], calculations show that 64.1 billion std. cu. ft. would be evolved from the reservoir crude oil to fill the gas cap provided no original gas cap were present. If the assumption is made that none of the original free gas in the gas cap comes to the surface during this period, it is seen that this free gas will expand as the pressure falls from 2640 lb. down to 1990 lb. If this same reservoir had an original gas cap occupying 50 per cent of the oil-gas pore space, the following calculations would show the size of the reservoir: Further assume that no original free gas in the gas cap comes to the surface.

Let V = Total Volume of Original Reservoir in million barrels.

Then 0.5V = Total Volume of Original Gas Cap in million barrels.

Let G = Volume of Gas Cap in million bbl. when the pressure = 1990 lb.

(1) Volume occupied by original gas cap at 1990 lb. pressure

$$\frac{0.5V \times 2640}{1990} \times \frac{0.83}{0.82} = 0.672V$$

(2) Actual volume occupied by gas evolved from reservoir crude oil to fill gas cap.

64,100 million x 0.00699 = 448 million cu. ft. or 79.7 million bbl.—0.172V since 0.172V equals the increase in volume of the original gas in the gas cap, due to the decrease in reservoir pressure. Where 0.00699 = volume of a standard cubic foot of gas at reservoir conditions,

G=(1)+(2)=0.672V+(79.7—0.172V)

Total volume of reservoir (V)=(1)+(2)+(3)

(1) Gas Cap

(2) Volume of Residual Crude to produce excess gas plus dissolved gas remaining.

(3) Volume of crude for gas cap plus remaining dissolved gases or

(1) 0.67V+(79.7—0.172V) million barrels

(2) 276×1.293=357 million barrels

(3) $\left(\frac{64{,}100-0.172V}{147} \times \frac{1}{1}\right) 1.293 = 564-0.223V$ (where 147 cu. ft. is the amount of gas evolved per barrel of crude) from 2640 lbs. down to 1990 lbs. pressure.

V=1384, total size of oil-gas reservoir in million barrels

0.5V=692, space occupied by gas cap in million barrels

0.5V=692, space occupied by liquefied crude in million barrels.

Size of reservoir= 1000 million barrels (saturated crude oil) based on a constant volume for the oil-gas reservoir, and no original gas cap.

It is seen, therefore, that the size of the oil-gas reservoir is somewhat larger than when the pore space was assumed to be filled entirely with saturated liquid. The amount of crude oil present in the former, however, would be only 69.2 per cent of the quantity existing in the smaller reservoir completely filled with saturated crude oil.

Conclusions

Certain hypothetical cases have been discussed in this paper. However, with solubility-shrinkage and P-V-T data on the original bottom-hole fluids of a reservoir, along with fairly accurate statistics on the production of oil and gas, the actual quantity of fluids (liquid and/or gas, in a reservoir can be estimated by means of the material balance. Such factors as water encroachment and the presence of an original gas cap should be considered for under certain reservoir conditions these variables may affect the calculated results markedly.

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Reward 5 In Wagonwheel

In North Belridge, Reward No. 5 has been drilled to the wagon wheel zone by the Associated Oil Co. The well is standing at 8520 ft. while preparations are being made to swab.

Engineers Get Trailer

Oh, for the life of a petroleum engineer! Joe Jensen, chief petroleum engineer, Associated Oil Co., informs us that in drilling that company's Wiley Canyon wildcat, continuous coring is underway and it has become necessary for the petroleum engineers to be on call 24 hours a day. Since there are no street cars in that country and with the nearest telephone some seven miles away, Associated is supplying the engineers with a complete house trailer in which the men can sleep at night in some degree of comfort and still be on call whenever needed.

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HOUSTON, TEXAS

Recent Kettleman Developments

(Continued from Page 7)

into a unit plan but failed or was unable to apply the necessary pressure to bring in the fee land owners. In a practical sense, therefore, there is no unit operation at Kettleman. The North Dome of Kettleman Hills is being developed competitively and wastefully in spite of the efforts of the Kettleman North Dome Association. Less than 5% of the participating acreage of Kettleman Hills has set the pace for development and has dictated the internal allocation of oil production. For four years since unitization, Kettleman, representing one-third of the reserves of the state and one-fifth of the potential, has produced on an average of 60,000 bbls. per day. (See Chart—Fig. I.)

Gas Domination

It may not be entirely accurate to place all the responsibility for setting the pace of production on the non-unitized operators. Kettleman is a major source of supply of gas for the utilities. Although the field had produced 137,830,931 bbls. of oil to Sept. 1, 1936, some interests still conveniently insist that it is a gas field. The rate of gas withdrawal has been an important factor in the manner of producing the field. It would be most fortuitous if the pace of production set by demands of the gas utilities were proper and efficient.

Of the state's production Kettleman North Dome currently produces daily 78,000 bbls., or 13.6% of the oil and 411,653 gallons or 25.75% of the natural gasoline. Of the gas delivered to utilities, Kettleman is furnishing 200,000 mcf daily or 41.6%.

Importance of Gas

In order to appreciate the importance of gas in the Kettleman situation it should be borne in mind that a gas cap originally occupied a restricted elliptical central portion of the field. From the upper part of the Temblor formation within the gas cap, wells produce a 60 gravity oil at ratios as high as 100,000 cubic feet per barrel of oil. From the lower part of the Temblor within the gas cap and annularly outside the gas cap is a so-called black oil belt with wells which, prior to expansion of the gas cap, produced oil as low as 35 gravity with gas/oil ratios of less than 1000 cubic feet per barrel.

A free and open outlet was maintained for gas, whereas a severely restricted outlet was set upon oil. This condition placed a premium on high gas/oil ratios and dissipation of the gas cap.

The following comments on this situation were made by the Petroleum Administrative Board in its report and recommendations relative to appeal of Superior Oil Co. and Amerada Petroleum Corp. from the general method of intra-field allocations in effect in Kettleman Hills North Dome since May 1, 1934:

"A survey of the record of this case and other official sources of information shows that the production of hydrocarbons from the Kettleman Hills North Dome field from Oct. 5, 1928, to Dec. 31, 1934, has been as follows:

	Crude Oil Total Barrels Daily Average	Natural Gas Total Mcf. Daily Average	Gas-Oil Ratio	Natural Gasline Total Gallons Daily Average
1928	2,377-84 days	36,000 est.	15.0	
1929	5,355	114,844	21.4	74,490
1930	16,946	409,258	24.2	428,531
1931	48,043	377,947	7.9	465,979
1932	59,970	270,807	4.5	372,021
1933	58,840	285,907	4.9	356,763
1934	58,253	319,410	5.5	411,113

Production data quoted above are brought to date as follows:

	Crude Oil bbl./Daily	Natural Gas Total Mcf. Daily Average	Gas-Oil Ratio Mcf./bbl.	Natural Gasoline Daily Average Gal.
1935	75,534	332,712	4.4	422,122
1936, Sept. 1	80,612	266,908	3.3	428,522

"The foregoing figures indicate clearly that the North Dome field is to be noted principally for its gas production rather than its oil. The record shows no dispute of the conclusions of the Advisory Board that

> 'the money value of the energy stored in the gas is worth many times more than the market value of the gas as fuel'.

"It is to be inferred then that North Dome operators are in agreement on this fundamental tenet, but it is apparent from the foregoing figures that the gas cost of producing oil is either excessive or that the revenues received from the sale of gas exceeded its value for the production of oil. Otherwise it would be difficult to justify the preponderant production of gas to date from a field with characteristics indicating that the most efficient recovery of oil can be obtained only by the complete utilization of natural gas as a propulsive and lifting agent. The conservation of oil in fields of the North Dome type very definitely depends upon the conservation of the associated gas."

Gas sales in Kettleman are divided among various operators approximately as follows:

Dry Gas Sales—July, 1936

	Mcf.	% Total
Kettleman North Dome Association	1,958,690	33.3
Standard Oil Co.	3,198,503	54.2
Others	733,674	12.5
	5,890,867	100.0

Figure II shows the sales of gas from Kettleman Hills from January, 1933, to date as compared with total utilization in the state.

Competitive Development Starts

With the termination of the shut-in agreement and start of operations under Kettleman North Dome Association, as of April 1, 1931, competitive development and production of the North Dome got into full swing.

On April 1, 1930, one year before Kettleman North Dome Association started operating, in accordance with affidavit filed by H. V. Dodd before Superior Court, County of Hanford, State of California, in connection with action of people of the State of California as *Plaintiffs* vs. Felix Oil Co. et al, *Defendants*, to prevent waste of gas, wells were producing in the North Dome of Kettleman Hills as follows:

Well No.	Dates Completed	Depth	Oil	Wet Gas Mcf.	Flow Pressure # Sq. In.	Natural Gasoline Gal.	Dry Gas Blown Mcf.	Dry Gas Utilized Mcf.
Continental 12-8	9-21-29	6,876	4,725	133,290	1,297	120,712	121,650	11,640
Milham Elliott 1	11- 7-28	7,108	2,798	83,081	1,050	77,775	57,995	25,086
*Pet. Sec. Felix 1	1,19-30	7,276	1,166	31,395	c 660 t 495	22,945	29,232	2,163
Standard 8-1P	12-30-29	7,108	3,770	102,593	625	98,491	62,464	40,129
			12,459	350,359		319,913	271,341	79,018

*Not in shut-in agreement of July 25, 1929.

On July 1, 1930, the following wells were producing:

On July 1, 1930, the following wells were producing:

Well No.	Completed Dates	Depth	Oil	Gas Wet Mcf.	Pressure Flow # Sq. In.	Gasoline Natural Gal.	Blown Dry Gas Mcf.	Utilized Dry Gas Mcf.
Continental 12-8	9-21-29	6,876	3,362	119,003	1,350	134,071	110,026	8,977
Milham Elliott 1....	11- 7-28	7,108	1,975	68,620	1,200	64,925	49,870	18,750
*Pet. Sec. Felix 1...	1-19-30	7,276	821	25,076	c 620 t 570	29,295	20,885	4,191
**Standard 38-35J ..	4-18-30	7,392	2,472	68,585	c1,400 t 500	70,672	63,398	5,187
Standard 8-1P	12-30-29	7,108	3,045	92,295	875	83,564	43,733	48,562
Standard 81-11P	4- 3-30	7,035	2,521	86,877	825	84,288	80,819	6,058
Total 7-1-30			14,196	460,456		466,815	368,731	91,725

* Not in shut-in agreement of July 25, 1929.
** Offset to Petroleum Securities Felix 1.

On November 1, 1930, the following wells were producing:

Well No.	Dates Completed	Depth	Oil	Wet Gas Mcf.	Flow Pressure # Sq. In.	Natural Gasoline Gal.	Dry Gas Blown	Dry Gas Utilized Mcf.
*Associated Whepley 1	8-17-30	7,904	2,132	54,383	t 575 c1,020	65,908	30,910	23,473
Continental 12-8	9-21-29	6,876	2,464	99,220	1,350	119,648	83,005	16,215
Milham Elliott 1	11- 7-28	7,108	1,632	61,956	1,200	63,539	41,003	20,953
*Pet. Sec. Felix 1..	1-19-23	7,276	254	15,907	c 620 t 640	17,061	11,200	4,707
Standard 38-35J	4-18-30	7,392	1,476	43,183	c1,700 t 600	37,306	40,819	2,364
Standard 8-1P	12-30-29	7,108	2,535	82,252	875	69,470	31,879	50,373
Standard 81-11P	4- 3-30	7,035	2,168	82,488	825	68,550	30,899	51,589
*Superior "Huffman" 1 ..	9- 4-30	8,323	11,552	42,015	c1,120 t 944	13,146	41,358	657
Total 11-1-30			24,597	481,400		454,628	311,073	170,331

* Not in shut-in agreement of July 25, 1929.

The above show the following:

(1) During the year 1930, the elements of competitive development were gathering strength through completion of wells by Petroleum Securities, Associated Oil Co., and Superior Oil Co., none of which were part of the so-called shut-in agreement.

(2) In the latter part of 1930, Superior Oil Co. with its Huffman 1 was producing almost half the oil coming from the eight wells then producing in the field. It was producing about 1/10 of the gas.

(3) 311,073 mcf of gas was being blown to the air during November, 1930.

(4) Of the 480,000 mcf of gas available only 170,000 mcf was being utilized.

(5) Of the 170,000 mcf utilized, Standard Oil Co. had an outlet for 104,000 mcf.

(6) Two wells—Milham and Continental—could not be shut-in and were blowing 125,000 mcf daily.

(7) All wells except Superior's Huffman were producing with high gas/oil ratios varying from 25 to 40 mcf per barrel of oil. Superior's Huffman gas/oil ratio was about three mcf per barrel of oil.

(8) Six months before the shut-in agreement was terminated, three wells, not in the agreement, were producing more than half the oil in the field and were not contributing to the drainage fund.

The California gas law, based upon the premise that the blowing of gas to the air is prima facie evidence of waste, and ostensibly framed to prevent the waste of gas but actually conceived and sometimes invoked to control the production of oil was used as the basis of the above mentioned action. Issuance of a temporary injunction hinged largely upon such factors as optimum gas/oil ratios and the proper or appropriate definition of waste. Waste was variously interpreted to be underground waste, energy waste, economic waste, or perhaps just physical waste, with the result that court, lawyers, engineers and experts were more or less perplexed by the confusion into which their own arguments and inventiveness had brought them.

Temporary injunctions, which caused no appreciable pause to the competitive forces that were gaining momentum during the period that the unit plan was being formulated, were issued.

The case hung in the court for several years and was finally taken off the calendar. It is noteworthy that the same group of major companies that so strongly advocated unitization and were currently contributing to the construction of the unit plan, although finally refusing to place their acreage in the plan, were on the side of the state in the gas units.

The gas suits failed to effect equitable control of oil production at Kettleman. At the end of 1930 the field's production was about 25,000 bbls. of oil per day and 480 million cubic feet of gas. By Aug. 1, 1931, the production of Kettleman North Dome Association, Standard Oil Co. and Superior Oil Co. was such that some form of curtailment appeared necessary.

Part 2 will appear in next week's issue.

■ ■ ■

Kettleman North Dome Mince Pie Or Lemon?

(Continued from Page 4)

the witnesses for the plaintiffs explained, the question is one of whether the structure should be compared to a mince pie or whether it more nearly resembles a lemon pie. In other words, he said, if a toothpick were to be pushed down into a lemon pie, it would encounter practically the same ingredients, or the same formation, at any point in the pie. However, were a toothpick to be sunk into a mince pie, it would be impossible to determine in advance what the toothpick would encounter. At one point it might run into one thing, and right alongside of that position it might run into something entirely different.

"Mince Pie" Case

The entire strategy of the trial to date has been the effort of the plaintiffs to build up their "mince pie" case—to show that the structure is faulted and that it is impossible to define the productive limits of the field without thorough exploratory drilling of every area. While no statement has yet been made as to the number of wells the plaintiffs believe should be drilled to prove the questioned territory, at one point in his discussion, Harry Johnson made the remark that "to completely prove the territory it would be necessary to have a black ring of derricks around the entire field; this, of course, would be economically impractical."

Independent Petroleum Association Meet Discusses Tariff; Depletion Tax Allowance

ON MONDAY and Tuesday of this week the Independent Petroleum Association met in Oklahoma City with a program covering a wide range of subjects of the greatest interest to the oil industry of the entire nation. California's attendance was unfortunately small. Rush M. Blodget, executive vice-president of the Oil Producers Agency, represented that organization. He was not scheduled to make an address but will submit a report to the Directors of the Agency. J. R. Pemberton, state umpire, has gone to Oklahoma City to attend the Interstate Oil Compact Conference to be held at the time and attended the sessions.

Only one Californian is on the program. Angus J. Crites of Bakersfield, who will represent the Independent Oil Producers Agency, will speak on the subject of "Restriction of Imports An Essential Part of Any Constructive Program for the Domestic Petroleum Industry", a topic of the most far-reaching importance to all producers and refiners. Mr. Crites spent Thanksgiving day with his brother at Harrisburg, Pennsylvania, and stopped over at Oklahoma City on his way home. He was scheduled to speak on Monday afternoon.

Another address of especial interest everywhere oil is produced was that of Hon. Wesley E. Disney, Tulsa, Okla., member of the Ways and Means Committee, House of Representatives, on "The Necessity and Justice of the 27½% Depletion Allowance to Oil Producers". Rep. Disney is looked upon as the certain leader of the battle to save this valuable right of producers from overthrow by those who have always sought to break it down in the interests of greater tax returns. California oil organizations and companies have been active in the fight ever since the question was first raised in Congress.

Among other addresses of particular interest on the program are the following:

"The Benefits of a Permanent, Assured and Effective Balance of Supply with Demand to the Refining Branch of the Petroleum Industry", by C. M. Boggs, president, Western Petroleum Refiners Association, Arkansas City, Kansas.

"Taxation" by Baird H. Markham, Director, American Petroleum Industries Committee, New York.

"Conservation and Stabilization Synonymous in the Petroleum Industry", by Dr. Virgil R. D. Kirkham, Economic Geologist, Saginaw, Michigan.

"The Benefits That Will Accrue to the Petroleum Industry from the Accomplishment of the Five Point Program of the Independent Petroleum Association of America", by J. D. Collett, president, General Mid-Continent Oil & Gas Association.

"The Interstate Compact" by Col. E. O. Thompson, Austin, Texas, chairman, Interstate Oil Compact Commission.

Chas. Roeser, president, in his address devoted attention to the subject of "Unnecessary and Excessive Drilling", a problem to which the Association is giving attention.

On Tuesday, a luncheon was given to representatives of the press and the oil trade journals.

■ ■ ■

J. W. Wood, secretary of the company, expects to return from the east about Dec. 15, ending a month's vacation in New York and other Eastern points. Mr. Callahan expects to take a vacation following Mr. Wood's return.

Macrate Erects Derrick For Santa Maria Well

A. N. MACRATE is erecting a derrick for another well, Fernandez No. 1, in the Santa Maria area. The new location is about one mile due west of the Hancock-Bush Brown No. 1 producer, and on sec. 26,10-34. Macrate's Rice No. 1, in sec. 23, 10-34, is making about 125 bbls. per day, still cutting some sand and mud. The oil is slightly better than 16 gravity.

After getting about 50 ft. of oil sand above 4850 ft., R. R. Bush Oil Co. continued the drill to 4900 ft. and ran an electrical logging instrument, and is preparing to cement casing. At about 4870 ft., cores showed steep dips.

Apache Oil Co. has plugged its Carreaga No. 1, in sec, 31, 9-33, to 4350, after having drilled to 4996 ft. Casing will be set at 4190 ft. for a test of the formations between that depth and 4350 ft.

Ralph Douglas has subleased his Santa Maria lease to Oil Properties, Inc.

Los Alamos-Gato Ridge

Barnsdall Oil Co. has cored the top of the oil sand at 1799 ft. and is testing the 10-inch shut off at that depth in itsTognazzini No. 2 on sec. 9, 8-32. Bottom of the hole is at 1868 ft.

Benjamin A. Moyle and associates are starting a foundation for a well on their 31-acre lease, Gato Ridge, on sec. 4, 8-32.

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Two Representatives Join Tunnell, Wood & Neilan

Vernon H. Anderson

Joseph W. McGalliard

VERNON H. ANDERSON and Joseph W. McGalliard have joined the organization of Tunnell, Wood and Neilan, the former to be located at Avenal, from which he will serve the Kettleman Hills and Coalinga areas, and the latter located at Taft.

Mr. Anderson has been in the oil well supply business for many years, and Mr. McGalliard has been in the business for the past 15 years, the last 10 of which have been at Taft.

H. C. Smith Announces New Type Of Rock Bit

THE H. C. SMITH rock bit incorporates many new features in rock bit construction. The two gauge cutters have conventional roller bearings plus two thrust ball bearings, eliminating possibility of any play in the cutters, which would result in the formation's forcing the cutters inward, causing a loss of gauge in the hole.

A deep and proper-shaped tooth insures a maximum amount of diamond substitute metal plus the ultimate in the hardness of the metal itself.

The cross roller assembly is made of a special alloy steel. The pin is heat treated and greatly increased in size over the conventional cross pin, eliminating any danger of breakage.

Accompanying is a cut of the model BR (barrel roller type), one of the successful designs used in H. C. Smith service for California. Shape of cutters insures a maximum clearance for circulation wash, plus a tooth proportion equal to the area of the hole being cut.

A full line of rock bits is carried, for soft, medium and hard formations. The different formations encountered in the various fields tends to decrease the efficiency of any one type of cutter tooth. With this in mind, Smith engineers have evolved several types of cutter tooth edges, designed particularly to allow easy penetration and fast cutting by the bit. Inherent characteristics of this bit are its smoothness in operation and ability to dig straight holes.

This company has completed the installation of new and heavy duty oil tool equipment to facilitate the production of the new rock bits.

■ ■ ■

Frank Seaver: "Go easy. This hill's not too safe."

John Sickler: "Can't slow down—the brake's not working."

Frank: "You don't mean—"

John: "Oh, don't get panicky, the horn's all right."

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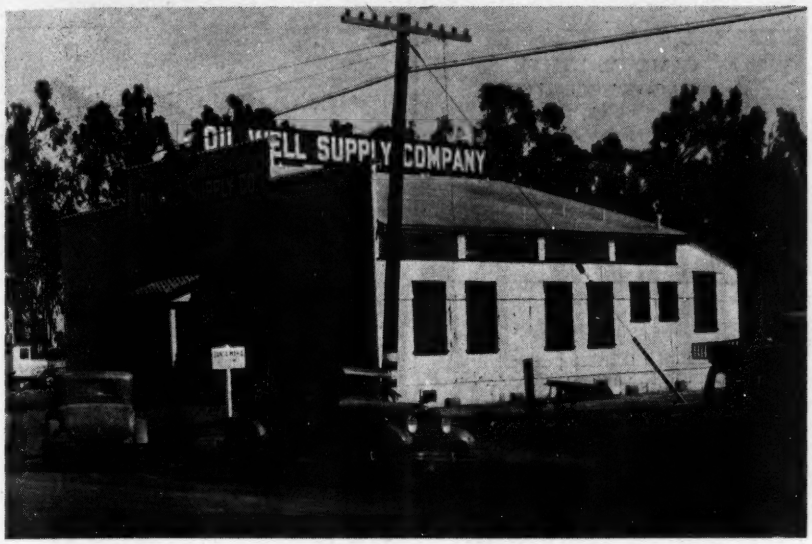
Oil Well Supply Opens New Santa Maria Store



TO BE of more service to oil operators in the Santa Maria area, the Oil Well Supply Co. has opened a new supply store on the coast highway adjacent to the oil field development in that region.

F. E. Millard, who has had considerable experience with the Oil Well Supply Co., has been appointed manager. H. C. David was made field salesman and B. N. Cox has been transferred from Ventura to act as foreman.

The telephone number is Santa Maria 1049; mailing address is Box 636, Santa Maria.

■ ■ ■

Oliver Field: "Do you know Sally Rand intimately?"

Ed Fisher: "Do I? I'm one of her fans."

Brown Issues Broadside

The Brown Instrument Co. has just published a new broadside entitled: "Here's the Answer to Your Temperature Problems", featuring Brown Thermometer Controllers.

This new broadside describes Brown Controllers. It illustrates the application of Brown Air-o-Line Thermometer Controllers to specific process requirements and in addition gives in detail the features and the ranges of both air operated and electric types of controllers.

Also, the new broadside presents a complete description of Con-Tac-Tor Mercury Switches.

■ ■ ■

Data On Sicromo Steels

The Timken Steel & Tube Co. has just prepared a new eight-page booklet presenting additional information on the Sicromo 1, 2, 3, & 5 steels recently announced. This booklet, which is free upon request, gives the analyses of these new steels and discusses the effect of both silicon and chromium on the oxidation resistance of steels in which they are used.

■ ■ ■

A recent article in a national magazine on the discovery and development of gold north of Winnemucca, Nevada, where there is much activity at present and fortunes are reported to have been found, reveals the fact that R. W. Hanna, director of Standard Oil of California, and a group of San Francisco associates, are operating one of the leading mines in that area.

Continental Quitclaims Leases In East Coyote

AFTER TWO FAILURES to get oil, Continental has given up the effort and has quitclaimed its Carlton Community leases in the East Coyote field. Bar Oil Co. suspended operations at 3100 ft. Oil Conservation, Ltd. took the project over and took it down to 3212 ft. Nothing but gray sand was uncovered, so the well is being abandoned.

Undeterred by these failures, V. R. G. Wilbur has acquired eight acres from Fred De Augustine and John R. Abrams and will drill shortly. Derrick has been erected, the location being near the Abrams-De-Augustine producing well, and southwest of the intersesction of Golden and Western aves.

Hancock has made a location for Stebbins No. 1, but has done nothing further and may not drill.

Holly Development Co. is redrilling, at 2680 ft., and cleaning out its Barnett No. 1. The bottom is at 4500.

Oil Conservation, Ltd., may have its Jessup No. 1 completed shortly. It has been drilled to 2814 and cemented 100 ft. above.

■ ■ ■

Fruitvale Well Swabbing

Geo. K. Linderman No. 1, in sec. 28, 29-27, Fruitvale, is swabbing, with bottom at 4248, and casing cemented at 4157 ft. The well adjoins the Gulf Oil and Superior Oil holdings.

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Dividend Arrears Paid

Shell Union Oil Corp. eliminated arrears on its preferred stock by declaring a dividend of $26.12½ on Nov. 23. Payment was resumed on the common stock at the same time. The dividend on the preferred amounted to about $10,000,000 while the common stock payment added another $3,000,000 to the $650,000,- in dividends declared by approximately 250 corporations anxious to disburse 1936 earnings and reduce tax liabilities incurred under the federal levy on undistributed profits.

■ ■ ■

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Grapevine Well Spudded

The 98 Oil Co. has spudded in a new well on the Tejon ranch close to the Grapevine route, and to the old Badger well. W. W. Stabler, one of the owners of the company, will be in charge. The company is financed largely by the group that started the effort to find oil in this vicinity. The spud was a technical one and nothing further is known to have been done yet.

An effort will be made to complete the well drilled by L. C. Gould and associates. Its mechanical condition is known to be poor and the hole too small for good production but the hole can be cleaned out, deepened and establish whether oil is there at less cost than by a new well.